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The Pan-Pacific Entomologist

Vol. XXXVII April, 1961 No. 2

A NEW GENUS AND FIVE NEW SPECIES OF CALIFORNIA TEPHRITIDAE

(Diptera)

F. L. Blanc[1] and Richard H. Foote[2]

While identifying specimens in a study of the tephritid fauna of California, the authors found the new species and record presented below. *Myoleja unifasciata*, n. sp., is the third North American member of the genus and the first record of the genus in California; *Aciurina trilitura*, n. sp., is the tenth North American and the seventh Californian *Aciurina; Procecidochares stonei*, n. sp., is the eighth North American *Procecidochares* and the fifth California one to be described; *Neaspilota wilsoni*, n. sp., the eighth North American and the third California one; *Urophora timberlakei*, n. sp., is the third California species of *Urophora* to be recorded—the species in North America have never been adequately reviewed; and *Cryptotreta*, n. gen., has been erected for *Eurosta pallida* Cole, here recorded for the first time in California and the United States. Where pertinent, new keys to species, or modifications of existing ones, are presented to aid the user in distinguishing the new forms described herein.

The authors wish to extend their sincere thanks to the following institutions, the collections of which were so kindly made available for study (abbreviations used throughout the text are indicated in parentheses): California Academy of Sciences, San Francisco (CAS); California Department of Agriculture, Sacramento (CDA); California Insect Survey, University of California, Berkeley (CIS); University of California, Davis (UCD); University of California, Riverside (UCR); and the U.S. National Museum, Washington, D.C. (USNM). Specimens from the senior author's collection are indicated by (FLB).

Myoleja unifasciata Blanc and Foote, new species

(Fig. 1)

Male.—Head. Brownish yellow, with face lighter than other parts; about 1.5 times as high as long; eye 2.0 times as high as wide; cheek narrow; frons 1.25 times as long as width at vertex, covered with fine,

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black hairs; lunule shallow; face distinctly widened below, in lateral view receding from antennal base to anterior oral margin. All head hairs black; three of four pairs fine lower fronto-orbitals, with some smaller hairs interspersed among them; two pairs reclinate and slightly diverging upper fronto-orbitals placed distinctly inside the line of lowers; one pair diverging proclinate ocellars about as long as posterior upper fronto-orbitals; hairs along oral margin anterior to genal bristle fairly well developed. Antennae orange yellow, arista distinctly yellow at base. *Thorax.* Subshining and entirely brownish yellow except for a black triangular mark occupying median two-thirds of sternopleuron, a small dark area immediately anterior to halter, and a narrow bright yellow stripe from humerous to wing base. Mesonotum rather densely covered by short but rather stout black setae; dorsocentrals black, placed directly in a line drawn between the supra-alars. Scutellum somewhat lighter yellow than mesonotum, with two well developed pairs scutellars. Halteres yellow. Legs, including coxae, entirely orange-yellow or yellow, with a tendency toward apical darkening of all femora. Wing (fig. 1) wide, rather blunt at tip, heavily infuscated with dark brown and with the following light areas; two in costal cell attaining vein sc; a blunt-tipped triangle immediately distad of stigma crossing vein R_{2+3} and ending upon vein R_{4+5}; a subapical arc originating in cell R_1 about halfway between apex of stigma and apex of cell R_1, following curve of wing tip and ending in apex of cell 2nd M_2, wider than dark band between it and wing margin; a second arc parallel to the foregoing one, originating upon vein R_{4+5} and terminating near margin of cell 2nd M_2 proximally; a suggestion of a light spot in distal two-thirds of cell 1st M_2 halfway between veins M_{1+2} and M_3+Cu_1, thence in a very narrow streak to subcosta; cell 2nd A almost entirely hyaline. Stigma about as long as proximal width; vein r-m connected to vein M_{1+2} much closer to vein m than its own length; cell 1st A drawn to a distinct point apically. *Abdomen.* Dark brown, the first two terga with a tendency toward more yellow than remainder; all terga rather densely clothed with fairly long, black hairs.

Female.—Not known.

Types (all California).—*Holotype male*, CONN CREEK, NAPA COUNTY, 23-IV-1949, W. W. Middlekauff (U.S. National Museum No. 65400). Paratypes: Same data as holotype (4♂♂, USNM); hills back of Oakland, 13-V-1951, W. C. Bentinck (1♂, UCD; 5♂♂, CIS); Oakland, 10-V-1937, E. S. Ross (2♂♂, CAS); Santa Monica Mts. with number 310519V1221 (1♂, UCLA); Deer Creek, Tehama County, 6-VI-1949, R. M. Bohart (1♂, UCD).

Discussion.—*M. unifasciata* is easily separated from *nigricornis* (Doane) and *limata* (Coquillett), the only other North American species of *Myoleja*, by the presence of a single costal hyaline wedge in cell R_1 distad of the stigma and by the absence

of a hyaline spot near the apex of cell 1st M_2. A key to the three known North American species of *Myoleja* is presented below:

1. Only one hyaline costal wedge present in cell R_1 distad of stigma; no hyaline spot near apex of cell 1st M_2.....*unifasciata* Blanc & Foote
– Two hyaline costal wedges present in cell R_1 distad of stigma; hyaline spot present near apex of cell 1st M_2.....2
2. Continuous submarginal hyaline arc occupying cells R_2, R_5, and apex of cell 2nd M_2; lower fronto-orbitals of male slender and sharply pointed.....*limata* (Coquillett)
– No such submarginal hyaline arc in area indicated above; lower fronto-orbitals of male enlarged and with blunt apices.....*nigricornis* (Doane)

Aciurina trilitura Blanc and Foote, new species

(Fig. 2)

Female.—Head. Distinctly higher than long; in profile cheek 0.30 to 0.35 times as high as eye; frons yellow, about 2.0 times as wide as one eye; length from vertex to lunule about equal to width at vertex; face whitish pollinose, antennal fossae very shallow, in lateral view not concave or noticeably projecting anteriorly at oral margin; antenna 0.45 times as long as face, third segment somewhat angular at antero-apical margin but not projecting into a distinct point. Two or three pairs lower fronto-orbitals; two pairs upper fronto-orbitals, the posterior pair whitish, ocellar as long as longest lower fronto-orbitals; inner vertical dark, outer vertical whitish; post-orbitals entirely white; genal bristle hardly longer or darker than a group of three to ten long, stout, blunt, whitish hairs situated at lower angle of eye. *Thorax.* Mesonotum brown, densely pollinose, without pattern, covered by numerous blunt, thick, white setae separated from each other by distances of less than half the average seta length except in immediate vicinity of bases of notopleural and anterior supra-alar bristles, which are bare; dorsocentrals much closer to suture than to a line between anterior supra-alars; scutellum pollinose, brown to yellow with very slight darkening at extreme base, especially laterally; one pair scutellar bristles; post-scutellum yellowish dorsally, black ventrally, as is middle third of meta-notum; lateral third of metanotum and pleural terga yellowish pollinose except sternopleuron, which is mostly black. Legs entirely brownish yellow, shining. Halter reddish yellow, the knob concolorous with stem. Wing (fig. 2) narrow, 2.5 times as long as greatest width; a distinct bulla present in cell R_5, around which vein R_{4+5} is distinctly arched; stigma narrow, 5.0 times as long as greatest width; vein r-m separated from vein m by a distance equalling 2.3 times length of vein r-m measured along vein M_{1+2}; cell 1st A ending apically in an elongation resembling an equilateral triangle. Pattern with the following hyaline spots: one in cell 1st C; two in cell 2nd C; two, small, in and near extreme base of cell R_1; three in cell R_1 distad of stigma, equidistant, at least the center one extending completely across cell and across vein R_{2+3} to fuse with a smaller, rounded spot in cell R_3; one, rounded, at base of apical

third of cell R; one, rounded, in cell 1st M_2 usually touching vein M_{1+2} distad of vein r-m; one, small, in cell R_5 touching vein M_{1+2} and crossing it to join an elongate diagonal spot in cell 2nd M_2, leaving cell R_5 otherwise completely dark; two additional in cell 2nd M_2, the distal-most large and extending diagonally from vein M_{1+2} to posterior margin; five of varying size in cell Cu_1; three to six, all inconspicuous, occupying cell 2nd A. *Abdomen.* All abdominal terga subshining black, covered with short, fine, brown to black setae; ovipositor sheath swollen on basal half or two-thirds, as long as last four abdominal terga taken together, similarly covered by brown to black setae.

Male.—Similar in all respects to female except external genitalia, which are large and shining.

Types (all California).—*Holotype female,* Camp Baldy Road, San Bernardino County, 26-VI-1956, A. Menke, Jr., in collection of California Department of Agriculture, Sacramento. Paratypes: Same data as type (2♂♂, CDA; 2♂♂, USNM); Tehachapi, Kern County, 26-V-1958, H. L. Wilson, ex *Chrysothamnus nauseosus* (1♀, CDA; 1♀, USNM); Neenach, Los Angeles County, 28-IV-1959, *Chrysothamnus* (1♂, CDA; 1♀, FLB); Pearblossom, Los Angeles County, 13-V-1956, W. E. Simonds, composite (3♂♂, 5♀♀, CDA); Desert Springs, Los Angeles County, 5-V-1956, J. Powell (1♀, CIS); Victorville, 21-IV-1935 (1♂, CAS); Frazier Park, Kern County, 29-IV-1959, F. L. Blanc, *Chrysothamnus* (1♀, FLB); Lone Pine, Inyo County, 29-IV-1959, R. P. Allen (♂, FLB); Tahoma, Placer County, 6-VI-1949, R. M. Bohart (1♂,UCD).

Discussion.—The apical hyaline spot in cell 2nd M_2 of two of the paratype males does not cross vein M_{1+2} into cell R5, leaving the latter entirely without hyaline markings. As far as we are aware, no other *Aciurina* possesses three hyaline spots in cell R_1; in this respect *trilitura* strongly resembles species of *Valentibulla* but lacks a hyaline incision at the apex of cell R_5.

A. trilitura is closely related to *trixa* Curran and *maculata* (Cole). It is immediately distinguished from both those species by the presence of three hyaline spots in cell R_1 apicad of the stigma, by the presence in cell 2nd M_2 of three distinct hyaline spots and in cell Cu_1 of five, and by the smaller size of the round hyaline spots in cells R and 1st M_2.

The only published key to the species is by Bates (1935); it may be amended to include *trilitura* as follows:

9. Wing brown at base.....10

– Wing hyaline from extreme base to humeral cross vein.....11

10. Three hyaline spots in cell R_1; three hyaline spots in cell 2nd M_2.....*trilitura* Blanc & Foote

– Only two hyaline spots in each of these cells.....*maculata* (Cole)

11. Cell 2nd M_2 with a large, rounded hyaline spot which occupies much of its area, in addition to the subapical band.....*trixa* Curran

– Basal portion of cell 2nd M_2 occupied by two hyaline spots, joined or not anteriorly to form an inverted V.....*bigeloviae* (Cockerell)

Procecidochares stonei Blanc and Foote, new species

(Fig. 3)

Female.—Head. In profile 0.7 times as long as high, face and frons meeting at antennal base at an angle of about 140 degrees; area between anterior margin of eye and frons 0.8 to 1.0 times as wide as third antennal segment; gena about 0.2 times as high as eye, which is not quite half as wide as high; frons yellow to velvet brown, at vertex 1.8 to 2.0 times as wide as one eye, 1.3 times as wide as length from vertex to lunule; lunule as high as its width at antennal base; face yellow to brownish white, pollinose, distinctly concave, but not produced markedly anteriorly at oral margin; antenna yellow to brownish white, pollinose, third segment sometimes rather deep brown along anterior margin and apex, arista brownish black to black, shining. Three pairs lower fronto-orbitals, one pair upper fronto-orbitals, all shining black; genal bristle very slender, situated immediately below lower curvature of eye; all postoculars white. *Thorax.* Pleural tergites mostly shining black, especially the sternopleurite, but with a very light pollinosity on upper half from propleurite to metathorax, which is densely silver pollinose over a black ground color; sternopleural bristle black, most remaining pleural setae rather long and white; lateral third of mesonotum, including humerus, shining black; a thin, silvery pollinose stripe on a shiny black ground color occupying median third of mesonotum from a point immediately behind head to scutoscutellar suture, with a slight widening at suture and with short, white, blunt setae (sometimes appearing yellowish) as follows: two rows, each two to four bristles wide, one occupying center and one the margin of median pollinose stripe, a patch at suture crossing shining area to lateral margin of mesonotum, four patches immediately anterior to scutoscutellar suture, and scattered setae on pollinose area behind suture. Dorsocentral bristle situated about halfway between suture and a line between the anterior supra-alars, and located precisely at margin of median pollinose area. Scutellum shining black, bulbous, two pairs scutellar bristles, with four to six short white setae surrounding base of basal-most pair; postscutellum black, darkly pollinose. Halter shaft dark yellow, knob infuscated. Femora of fore, mid, and hind legs dark brown but with yellowish knees, the yellow of fore femur more extensive than that on other legs, remainder of legs brownish yellow. Wing pattern as in fig. 3, stigma about 2.0 times as long as wide, distance between veins r-m and m measured along vein M_{1+2} about equal

to length of vein r-m; oblique hyaline area from stigma to posterior margin of cell 2nd M_2 nearly always complete. *Abdomen.* Brownish black, each tergum except the first with at least one row of black hairs on posterior half, and white, flattened setae on proximal half, the area covered by white setae increasing on posterior-most terga; terminal tergum 0.3 times as long as preceding. Ovipositor sheath shining brownish black, basal half slightly swollen, as long as all terga, except the first, taken together, but appearing shorter in many specimens.

Male.—Similar to female in all respects, but external genitalia dark brown.

Types (all California).—*Holotype female*, San Ysidro, San Diego County, 20-I-1948, E. D. Algert (U.S. National Museum No. 65401). Paratypes: Same data as type (1♂, 1♀, CDA; 2♂♂, 1♀ USNM); San Ysidro, 17-III-1949, reared stem of *Viguiera laciniata* (1♀, 2♂♂, CDA; 1♀, 4♂♂, USNM); San Ysidro, 5-III-1948, V. O. Miller, reared ex stem galls *Viguiera laciniata* (3♀♀, 2♂♂, CDA; 3♀♀, 2♂♂, USNM); San Ysidro, coll. 23-I-60, emerged 1-II-60, Ed Algert, ex *Viguiera laciniata* (6♀♀, 11♂♂, CDA); Tracy, San Joaquin County, 25-V-1942, H. W. Graves, collected from alfalfa, CDA No. 42F9 (1♀, CDA); Deep Creek, Mohave, 25-X-1952, Timberlake (1♂, UCR); Oakland, 2-IV-1955, B. Hudson (1, sex not known; CIS).

Discussion.—*P. stonei* is a large species comparable in size to *Procecidochares anthracina* (Doane) and *P. grindeliae* Aldrich. It is distinguished from those two species by its lack of a presutural dorsocentral bristle. In the only published key to the species of the genus (Aldrich, 1929), *stonei* runs to *P. minuta* (Snow), from which it may be separated by the shape of the pollinose mesonotal area containing the pale hairs. In *minuta* this area is strongly constricted at the acrosticals while in *stonei* it is parallel-sided, causing the acrosticals to arise from inside the pollinose area rather than from the adjacent dark, shining surface.

The species is named for Dr. Alan Stone, who first recognized it to be undescribed.

Neaspilota wilsoni Blanc and Foote, new species

Male.—Head. Entirely yellow, in profile 1.2 times as high as long; eye 0.80 to 0.85 times as high as head; gena 0.2 times as high as eye, parafacial area scarcely wider than basal diameter and arista; face deeply concave, with oral margin projecting anteriorly to level of junction of face and frons; frons at vertex 1.4 times as wide as eye and 1.2 times as wide as length from vertex to lunule; face in front view nearly parallel-

sided, not expanding noticeably to oral margin; antenna yellow, concolorous with frons and face, 0.7 times as long as face, third segment broadly rounded apically. Three pairs lower fronto-orbitals; two pairs upper fronto-orbitals, the posterior pair convergent; ocellar as long as longest lower fronto-orbital; inner and outer verticals concolorous with ocellar and fronto-orbitals; postoculars whitish but slender and sharply pointed. *Thorax.* Mesonotum with yellow ground color adorned with a tomentose black pattern which extends centrally from anterior margin to, but not including, dorsocentrals centrally, and to a point immediately behind, but not including, acrosticals, leaving a broad yellow band on lateral margin which includes humerus and presutural and supra-alar bristles; entire surface of mesonotum beset with short, white, moderately thickened setae; dorsocentrals almost imperceptibly anterior to a line through anterior supra-alars. Scutellum yellow, lightly tomentose, with two pairs bristles; postscutellum and metanotum black, heavily tomentose except centrally, where a shining black spot appears; pleural tergites principally yellow except for a small black spot immediately above hind coxa and the black lower two-thirds of sternopleuron. Halter yellow, sometimes with diffuse infuscation on external surface of knob. Legs entirely yellow. Wing disk without definite pattern except for a diffuse brown spot occupying proximal half of stigma; none of the veins darkened; proportion of length to width of stigma at its base as 7:3; veins R_{2+3} and R_{4+5} completely bare, including node; vein r-m about as long as twice the distance between it and vein m, measured along vein M_{1+2}; cell 1st A with a very short but distinct prolongation along vein Cu_2+2nd A. *Abdomen.* Tergum I completely yellow; tergum II with yellow ground color and with the following black subshining areas: One pair of small, submedian, elongated triangles, the points directed posteriorly and attaining half the distance from anterior to posterior margins, these two triangles scarcely connected anteriorly; one pair of similar but outwardly skewed, paired triangles lateral to submedian pair but not attaining lateral or posterior margins or tergum; terga III and IV similar to II, but all four triangles connected by a continuous dark area along anterior margin, the lateral-most triangles much larger. In some specimens submedian triangles not connected on any of the terga, and in males with abdomen severely contracted none of the triangles appear to be so; tergum IV 1.5 times as long as tergum III.

Female.—As in male, but paired black lateral triangles of abdominal terga usually shorter than submedian ones; ovipositor sheath yellow and when flattened, 1.2 to 1.5 times as long as width at base, viewed dorsally.

Types (all Fresno County, California).—*Holotype male*, JACOLITAS CANYON, 15-V-1956, H. L. Wilson, swept from composite, Calif. Dept. Agriculture No. 56E-183, in California Dept. Agriculture, Sacramento. Paratypes: Same data as type (3♂♂, 2♀♀, two of these pairs *in copulo*, USNM; 2♂♂, 1♀, one pair *in copulo*, CDA); Coalinga, 25-V-1956, H. L. Wilson, swept from

2
4
1
3

composite, Calif. Dept. Agriculture No. 56E-280 (1♂, 1♀, USNM; 1♂, 1♀, *in copulo*, CDA); 15 mi. n. of Coalinga, 28-III-1956, H. L. Wilson, collected from *Coreopsis calliopsidea* blossom (3♂♂, FLB); Coalinga, 21-V-1956, H. L. Wilson, Calif. Dept. Agriculture No. 56E-238-2 (1♀, CDA).

Discussion.—In the excellent key to the known species of *Neaspilota* by Quisenberry (1949), *wilsoni* runs to couplet 8 on account of the lack of darkening upon any of the veins or in any of the cells other than the stigma; the absence of any minute hairs on the anteroventral surface of the hind tibia of the male; and the yellow abdominal hairs. Couplet 8 of that key contains *signifera* (Coquillett) and *brunneostigmata* (Doane). From the former, *wilsoni* is distinguished by the light yellow veins and lack of dark cloud at the base of the costal cell; from the latter, *wilsoni* differs by the lack of anterodorsal setulae on the hind tibia and the distinctive markings upon the abdominal terga.

N. wilsoni is named for H. L. Wilson, who has contributed innumerable specimens to tephritid collections from the California fauna, and who collected the type series of this distinctive *Neaspilota*.

Urophora timberlakei Blanc and Foote, new species

Female.—Head. Frons, face, parafacial, and gena yellow; post-occipital area entirely shining black; in profile head as high as long; eye 1.2 times as high as wide; distance between anterior margin of eye and face 0.6 times as wide as greatest width of third antennal segment; frons as wide as length from vertex to lunule and 1.4 times as wide as one eye at vertex, scarcely narrowing anteriorly; from front view face narrow, somewhat widened below, almost entirely hidden by the comparatively large antennae, antenna 0.8 times as long as face; from lateral view face projecting strongly anteriorly at anterior oral margin. All head hairs very slender and shining black; two pairs lower fronto-orbitals, one pair upper fronto-orbitals; one pair diverging proclinate ocellars as long as longest lower fronto-orbital; postoculars slender, short, sharply pointed; genal setae anterior to genal bristle very slender and inconspicuous; arista very dark brown or black except at extreme base, which is bright yellow. Mouthparts geniculate, the labellum slender and as long as, or longer than, head. *Thorax.* Mostly dark brown to black and shining except for a tomentose patch on mesonotum occupying central portion of area between anterior margin and suture,

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EXPLANATION OF FIGURES

Right wing, species of California Tephritidae. Fig. 1, *Myoleja unifasciata*, Blanc & Foote, fig. 2, *Aciurina trilitura* Blanc & Foote, fig. 3, *Procecidochares stonei*, Blanc & Foote, fig. 4, *Cryptotreta pallida* (Cole).

and extending posterior to insertion of dorsocentral; a narrow, bright yellow stripe, slightly widening behind, beginning on posterior third of humerus and running directly to wing base. Scutellum, postscutellum, and mesothorax concolorous with mesothorax: dorsocentrals in a line drawn between the anterior supra-alars; mesonotum with sparse black setae about one-third as long as dorsocentral; two pairs scutellars. Halter entirely yellow, with black setae on stem. Coxae, trochanters, and basal three-fourths to four-fifths of all femora dark brown to black, remainder of legs brownish yellow to yellow except for a slight darkening on middle third of mid and hind tibia. Wing hyaline, without pattern; costa apicad of stigma and all veins except Sc, R_1, and portions of M_3, Cu_1, and Cu_2 darkened; subcosta somewhat atypical for family in describing a curve toward costa rather than a sharp bend, stigma 0.4 times as wide at base as length; vein R_{4+5} completely bare; cell 1st A closed apically without any indication of elongation. *Abdomen.* Concolorous with mesonotum; tergum I shining; remaining terga slightly tomentose, together about as long as tergum I, covered sparsely with setae about as long as those on mesothorax. Ovipositor sheath circular in cross section but collapsed dorsally on basal half or more in type; normally enlarged on basal half; entire sheath as long as last four abdominal terga taken together.

Male.—Similar to female in all respects except external genitalia, which are bent beneath abdomen and hidden from dorsal view by abdominal tergum V.

Types (all California)—*Holotype female*, Morongo Valley, San Bernardino County, 27-IX-1941, Timberlake, ex *Gutierrezia lucida* (in collection of the University of California, Riverside). Paratypes: Morongo, 29-IX-1944, Timberlake (1♂, USNM); Barstow, 12-IX-1924, Timberlake, ex *Cleomella obtusifolia* (1♂, UCR); Summit of "Yucca V.", 28-IX-1941, Timberlake, ex *Gutierrezia lucida* (1, sex not known, UCR).

Discussion.—*U. timberlakei* is distinctive among all the *Urophora* in having no dark pattern on the hyaline disk of the wing—we therefore have no hesitation in describing it as new in spite of the fact that the genus is badly in need of revision. *Urophora formosa* (Coquillett) is similar in many characters but has wide wing bands and a yellow spot at the center of the scutellum.

We name the species for its collector, P. H. Timberlake, in acknowledgment of the many tephritids he has made available for study.

Genus **Cryptotreta** Blanc and Foote, new genus

(Fig. 4)

Diagnosis.—Proboscis normal, not geniculate: third antennal segment

rounded apically; three pairs lower fronto-orbitals; two pairs upper fronto-orbitals, the posterior pair not convergent; postoculars whitish; one pair dorsocentrals, very close to suture and distinctly anterior to a line between the anterior supra-alars; two pairs scutellars; wing with an indistinct bulla; vein m about its own length from vein r-m as measured along vein M_{1+2}.

Type species.—*Eurosta pallida* Cole (1923:472; fig. 10. Holotype male, San Francisquito Bay, Baja, California, 10–V–1921, E. P. Van Duzee—in the collection of the California Academy of Sciences). Monobasic.

Discussion—The description and wing figure presented by Cole are more than adequate to identify *pallida* among all New World Tephritidae. Cole placed the species doubtfully in *Eurosta* on the basis of the wing characters, but it bears a much closer resemblance to certain species of *Eutreta* in the position of the dorsocentrals, the number and character of the fronto-orbitals, and the habitus. It is not greasy as are so many specimens of *Eurosta* in collections. The distinctive wing does not at all fit the generic pattern of *Eutreta*.

The material studied is a single female from San Ysidro, San Diego County, California, caught in a McPhail trap in a shade tree, 12-IV-1960 by Tom Williams. It bears California Department of Agriculture No. 60D22-22, is in the collection of that institution, and is only the second specimen known. The ovipositor sheath is yellow medially, narrowly black proximally, and with a dark apical ring about as wide as the apical diameter of the sheath. Dorsally the sheath is about 1.5 times as long as tergum V.

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NOTE ON TWO EDITIONS OF J. C. BRADLEY'S 1919 PAPER "AN ENTOMOLOGICAL CROSS-SECTION OF THE UNITED STATES"

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In 1919 Professor J. Chester Bradley of Cornell University published a fascinating account of a collecting trip taken by a group of entomologists and friends. With a Buick, two Fords and a trailer, they drove, dug and pushed their way from Ithaca, N.Y. (May 24, 1917), to Berkeley, California (August 30), with side trips, for a total of 6,094 miles.

Apart from being interesting reading, the articles have many valuable distribution records of insects of at least eight orders (especially Lepidoptera and Hymenoptera), including specific names, exact localities, and in many cases host plants.

The original appeared in Volume 8 of *The Scientific Monthly* (parts 4: 356–377; 5: 403–420; 6: 514–526; the April, May June issues), with a map and 37 un-numbered text figures.

The three parts were subsequently reissued under the same title, continuously paged 1–54, and marked on the title page [cover] as being "Reprinted from THE SCIENTIFIC MONTHLY, April, May, June, 1919." Persons who have only the "reprint" should treat it bibliographically as a separate item, published by The Science Press. Especially, they should not imagine that they can tell from it on what page of the original a given paragraph occurs. The make-up of the so-called reprint is almost all new; only one page of text is exactly the same; five pages consisting of single illustrations are similar, but four are out of sequence. Other than the map, all 37 text figures are differently placed, some by as much as 38 pages; portions of the text have been reset, a few parts of paragraphs transposed, and an 11-line footnote crediting photographs has been omitted. All of which in no way detracts from one's pleasure in reading the article!

BIOLOGICAL NOTES ON THE LEAF-CUTTER BEE, MEGACHILE (EUTRICHARAEA) ROTUNDATA (FABRICIUS)[1,2]

(Hymenoptera: Megachilidae)

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For the past fifteen years, many investigators have concentrated on the accumulation of biological information on the native bee species that appear to be efficient pollinators of alfalfa. Considerable biological data has been accumulated on several species of *Megachile*, since many of these species (or groups of populations within the range of a species) appear to exhibit oligolectic tendencies on this crop (Peck and Bolton, 1946; Hobbs and Lilly, 1954; Michener, 1953; Medler and Koerber, 1958; Stephen, 1955, 1956). The economic value of many of the leaf-cutter species as alfalfa pollinators has provided a strong impetus to the acquisition of biological information in this genus.

Information on *M. rotundata* (Fabricius) is of particular interest, not only because it exhibits strong oligolecty to alfalfa in areas of the Pacific Northwest, but also because it is one of three species of this sub-genus that apparently has been introduced into North America in recent times. The species was first recorded in 1937 by Mitchell from Rosemont, Virginia. Since that time it has been reported from Washington, D.C. (Krombein, 1948), Kansas, Missouri and Texas (Daly, 1952), and California (Hurd, 1954). More recently, G. E. Bohart *(in litt.)* has found it to be widespread in Utah; and the authors here report it to be abundant in southern Idaho and Oregon, east of the Cascade Mountains.

The species is widespread throughout Eurasia and was apparently introduced from that area. The American host records for this species (Daly, 1952; Hurd, 1954) as well as those available to the author from Europe (Osychiuk, 1959) indicate that the species is apparently polylectic, taking its pollen from a wide variety of floral sources.

Observations on the biology of this species were made in the

[1] Technical paper No. 1397, Oregon Agricultural Experiment Station, supported by National Science Foundation, Grant No. G 4575.

[2] Dr. T. B. Mitchell of North Carolina State College provided the determinations of the material on which this study was based. He suggests that there may be some question as to the validity in the application of the name *rotundata* to this form, which will only be solved through revision of the subgenus.

Snake River Valley of eastern Oregon and southwestern Idaho during 1959 and 1960.

Emergence

The first adults were noted during the first week in June. Emergence continued until late June, reaching its peak during the third week of the month.

Nesting sites

The species has been observed constructing nests in a variety of different situations. Most commonly, individuals appear to appropriate existing holes that closely approximate their own size. These include holes from which nails have been removed, hollow tubing, or stems of pithy plants in which the pith has been removed, or has desiccated, leaving an aperture the size of the bee. The species has also been taken in the process of nest construction in cracks in boards, narrow areas between pieces of stacked lumber, and beneath a coat hanging on the wall of an out-door granary building. Where a distinct groove or channel was available for the construction of the nest, the cells were placed in a typical linear fashion. However, in other situations, such as the nest constructed between the wall and the coat suspended from a nail in the wall, the cells were located in an erratic fashion covering an area of four to four and a half square inches. Within this accumulation of cells there were obvious tendencies toward a linear arrangement among many of the cells composing the irregular mass.

None of the females was observed in the process of excavating any of its own burrows, and apparently each occupied only an existing aperture or hole which was suitable for cell construction. It is possible that the female actually does modify the nesting tube when the nesting medium is pliable and soft, since small amounts of pithy residue were observed at the entrance to a nesting tube in western sumac (*Rhus* sp.).

Cells

In a typical nesting tube the cells are arranged in linear order as in other *Megachile* (fig. 1). Considerable variation in the number of cells per nesting tube has been noted with this species, and this appears to be a function of the length of the nesting tube that the particular female is occupying. Several females were noted constructing cells in very shallow holes in which no more

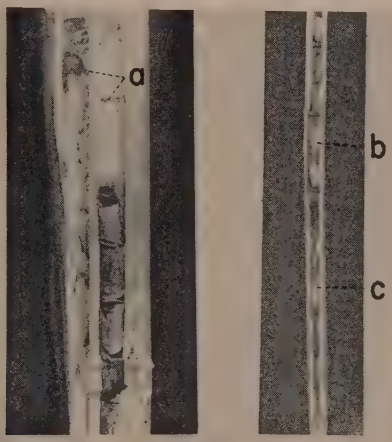

Fig. 1

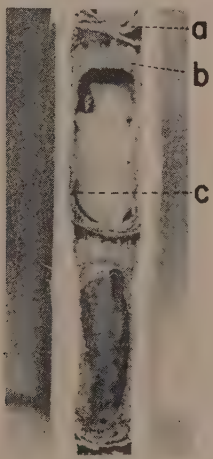

Fig. 2

Explanation of Figures

Fig. 1. *a*. Remnants of adhesive holding edges of cap leaves to inside of tunnel; *b*. Pupae in nesting tube dissected in very early spring; *c*. Overwintering prepupae in same nesting tube. Fig. 2. *a*. Typical four leaf cuttings forming the cap of each cell; *b*. Distinct pellets forming fecal mass at top of cell; *c*. Pupa enclosed by cocoon, one leaf and nesting tube.

than two cells could be constructed, while other nests were examined which contained as many as seventeen cells.

The walls and bottom of the cell are lined with a series of oblong leaves, overlapping each other on the bottom as well as on the sides. The dimensions of the oblong leaf-cuttings that compose the cup of each cell are variable, depending on the size of the bee and the dimension of the aperture in which the nest is being constructed. Those cells constructed in holes of approximately 4.5 mm. in diameter had but a single layer of four overlapping leaves lining each cell. These leaves ranged from 4 by 6 millimeters to 5 by 8 millimeters. Cells constructed in nesting tubes of larger diameter, *i.e.* 6 mm., were lined by two layers of leaves of slightly larger size. The authors assume that the two layers provided greater environmental stability within the cell and reduced the size aperture to that preferred by the bee. The cells constructed in cracks in wood or between two boards, and most particularly, those cells that lay between the wall and a coat suspended from a nail on the wall were all wrapped in several layers of leaf-cuttings. Six of the cells taken from between the coat and the wall were dissected. The cocoons were found to be covered by an average of 17 leaves. Those cells in more protected areas, such as cracks and crevices, had from eight to 14 leaves in the cup. It would appear that the female responds to the less desirable nesting areas by wrapping the cell in greater numbers of leaf-cuttings. This would insure a more uniform environment within those cells exposed to the rigors of climatic change. The interior dimensions of the cells vary slightly about a mean of 4.5 mm. in diameter by 8 mm. long, depending on the size of the nesting tunnel and the size of the adult female.

There was evidence of "filler" leaves in cells removed from oversized nesting tunnels, but these consisted solely of leaf-cuttings or leaflets of alfalfa. There was no evidence of outer or inner linings of soft petal cuttings to the cup or the cap, as reported for *M. brevis brevis* Say by Michener (1953).

After the cell had been lined, the female began filling it with a pasty pollen mass. The pollen laden female always entered the cell head first, presumably to deposit nectar, retreated to the entrance and backed into the cell to deposit the pollen. From one-half to two-thirds of the cell was filled and an egg was laid

on the surface of the pasty pollen mass. The cell was then sealed by a series of circular leaves of approximately the same diameter as that of the nesting tube. The cell caps were depressed slightly below the upper edges of the leaves, forming the periphery on the cell and assumed a general concave appearance (see fig. 2). The number of leaf-cuttings used for the cap varied from three to six leaves, placed one directly upon the other. At least one of these circular leaf-cuttings was glued to the leaves forming the cup, or to the inner face of the nesting tube itself. The remnants of this "glue" can be seen in figure 1 as dark resinous residue on the wall of the tube. The source of this adhesive material is unknown, but it is suspected to be salivary in origin, similar to the secretion applied to the interior of the cell by *M. inermis* Provancher (Stephen, 1955). The cell series continued to a point just beneath the entrance of the tunnel. The nesting tunnel was then plugged by a series of circular leaf-cuttings, the last of which was approximately level with the surface. These end plugs were composed of cuttings similar in shape and size to those which formed the cap of each cell. Most of the nesting tubes were plugged with eight to 15 leaves, but one was sealed with 33 leaf-cuttings. The leaves of the end plug were held in place by an adhesive applied between the edges of the leaves and the walls of the tunnel.

Adult behavior

Mating is believed to occur away from the nesting site, for there was no evidence of male activity about the nesting tube entrances during emergence. Neither were males noted in the proximity of the nesting tunnels at any time throughout the season.

The females are very rapid fliers. Because of their small size and nervous habits in the field, as well as their tendency to work in denser foliage than the honey bee or the alkali bee, it was difficult to observe their field behavior.

None of the females was observed taking pollen from any source other than alfalfa, even though volunteer sweet clover, sunflower, Russian thistle and mallow were available in close proximity to the nesting site. Pollen analyses from a series of cells revealed only alfalfa pollen. This preference for alfalfa in the area of observation conflicts with the polylectic tendencies

reported for this species. Since an absolute distinction between oligoletic and polylectic is unrealistic, the authors suggest that *M. rotundata*, or populations of that species, be designated as preferentially oligolectic. *Preferential oligolecty* applies to a species, or restricted populations of a species, that may be able to survive on a wide variety of hosts, but exhibit distinct preferences for one or more plant species when it is available. It is thus conceivable that a broad range of limited or specific host records for a poorly known species may lead to the implication that the species is polylectic, whereas in fact, the species or populations thereof, may exhibit rigid oligolecty when suitable nesting sites are found in the proximity of the preferred host. The maintenance of this type of ethological polymorphism in a balanced state would tend to convey a marked adaptive superiority to those species in which it is found.

Nesting observations were made on several females in early July and then again in late August to determine the time required to secure leaf-cuttings and pollen loads. Females in the process of collecting leaves were timed as they left the tunnel opening until they returned. It was found that females could cut the leaf and return it to the tunnel in from 10 to 20 seconds after their departure. Bohart *(in litt.)* reports that one female left the nest and returned with a leaf-cutting in five seconds. In early July, the pollen-collecting females returned to the nesting tunnel, pollen-laden, in from one and three-quarter minutes to eight minutes after their departure. By late August, the females required from four and one-half to 25 minutes to secure a load; but it should be noted that there was an extensive variation between loads and among individuals. One female, for example, required four and one-half minutes for one load, and twenty-six for the subsequent load. A second female was rather consistent, returning to the nesting tunnel in from six to eight and one-half minutes with eight successive pollen loads on the same day.

There are two factors which may account for the decrease in efficiency between the early July and late August observations. First, it may be a reflection of the effects of age on females' activity; or secondly, it may be that the females have utilized most of the available forage in close proximity to the nesting site and are obliged to travel greater distances for their food.

The very rapid accumulation of leaf-cuttings and pollen loads would indicate that the females operate in close proximity to the nesting site, with their absolute range controlled by the availabiliy of forage.

The adults exhibit distinct gregarious tendencies in their nesting habits. When a super-abundance of potential nesting sites is available to the population, the females completely fill the available tunnels in one area before expanding into those immediately adjacent to them.

Major adult activity extended from early June to late September and observations made on October 2 indicated that over 10 per cent of the original population was still actively engaged in cell construction.

Leaf-cuttings

All of the observations on *M. rotundata* were made in close proximity to blooming alfalfa fields, thus it may not be significant that the females of the species utilized only alfalfa leaves as a source of their nest linings. Invariably, the leaf-cuttings were obtained from the lower leaves of the alfalfa plants in proximity to the nesting site; and of these lower leaves, the older, yellowish leaves were used most extensively. This apparent fidelity to alfalfa as a souce of leaf-cutting may be only an indication of plant availability and that the species can utilize a wide variety of plants for leaf-cutting. Bohart *(in litt.)* reports that *M. rotundata* was observed taking cuttings from the petals of the sunflower *Helianthus*,, in Utah. However, their ability to utilize alfalfa as a source of both leaf-cuttings and forage undoubtedly contributes to the successful establishment of large localized populations of this species.

Larva

The larva matured rapidly, consuming the entire pollen mass within three weeks. Upon maturation, the larva deposited its fecal material at the top of the cell, just below the end leaf-cuttings (fig. 2) and commenced to spin its cocoon. It then transformed into the prepupa, in which condition it passed the winter (fig. 2).

A series of nests was removed from the field in October and placed in a jar at room temperature in the laboratory. The first emergence from these cells occurred on December 19, at which time two males and one female were noted flying in the jar.

Several nesting tubes and their contents were dissected at this time and each was characterized by the presence of pupae in the upper cells, while the lower cells contained the typical over-wintering prepupae (fig. 1).

There is only one generation per year of *M. rotundata* in the areas in which the studies were conducted.

Parasites and Predators

No parasites were observed visiting or investigating the tunnel entrances of this species in spite of the dense localized populations on which observations were made. In addition, rearing and dissecting of numerous cells has yet to reveal any insect parasites. If we accept as fact that this species was introduced into North America in relatively recent times, then it is possible that the indigenous parasites associated with this species in its area of endemism have either not been introduced or are lagging in their rapidity of dispersal.

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NON-GRANIVOROUS FOOD HABITS OF PHEIDOLE GRALLIPES WHEELER AND ITS POSSIBLE PHYLETIC SIGNIFICANCE

(Hymenoptera: Formicidae)

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Pheidole grallipes Wheeler (1916) is found in southern California and Lower California and is common near Ramona, San Diego County, California where I observed the ant in December of 1957.

Pheidole grallipes constructs larger nests than many species in the genus, throwing up mounds of soil several inches in diameter, which are often located at the bases of shrubs. Each colony may possess a number of queens, for, on overturning a large, flat stone covering one nest, I observed five de-alated females, and there may have been more in the deeper galleries of the nest.

Species in the large myrmicine genus *Pheidole* Westwood ordinarily feed on insects and seeds, but a number of species either have never possessed the seed harvesting habit or have lost it in the course of their evolutionary development. While granivorous species of *Pheidole* also feed on both living and dead insects and spiders, they are not so well equipped to capture their prey or to locate dead insects and carry them quickly homeward.

In the field in western North America it is often possible to distinguish the carnivorous from the granivorous species of *Pheidole* on a basis of external morphology. The granivorous species can usually be recognized because they tend to be stouter, with a greater disparity in the size of the major and minor workers than is the case with the carnivorous species, which do not harvest seeds. In comparison with the granivorous species, the carnivorous or entomophagous species are more elongate, have longer legs and

antennae and have mandibles, which, in relation to head size, are longer and sharper.

In contrast with granivorous species, the minor workers of the entomophagous species tend to possess a head which is more rounded or tapering behind the eyes, and their total body length more nearly approximates that of the major workers. The major workers of the entomophagous *Pheidole* usually possess heads which are subcordate rather than subrectangular or subquadrate.

The subgenus *Pheidole* Westwood is rather large and unwieldy, and a biological characteristic that may be of phyletic significance is noteworthy. The carnivorous or entomophagous species may form a monophyletic assemblage within this subgenus. In the American species of the subgenus *Pheidole*, the absence of the granivorous habit seems to occur primarily in Emery's Biconstrica, Fallax, and Fabricator Groups. Many species in the remaining three Groups seem to be granivorous. Those of the Subarmata Group are nearly all very assiduous harvesters. *P. grallipes* belongs to the Biconstricta Group (Emery 1921: 99).

While specialized feeding habits occur in certain groups such as the Attini and Dacetini, there has been a general evolutionary tendency in the Formicidae to broaden and diversify the primitive ponerine and myrmeciinine entomophagous habit so as to include other food items such as honeydew and seeds. The granivorous *Pheidole* often exhibit greater structural complexity than the entomophagous species, and it is in accord with Occam's razor to assume that the entomophagous species have not secondarily lost the granivorous habit but instead represent the primitive condition in this respect. If this is true, the entomophagous *Pheidole* may represent a connecting link between a polyphyletic assemblage of granivorous species and a primitive ancestral stock possessing monomorphic, entomophagous workers rather like those of the genus *Aphaenogaster* Mayr. The minor workers of some of the entomophagous species of *Pheidole* resemble workers of various species of the myrmicine genus *Aphaenogaster* Mayr, and the wing venation of the subgenus *Pheidole* closely resembles that of certain species of *Aphaenogaster*. Plates 18 and 21 in Creighton (1950) show this close resemblance of venation. Both *Pheidole* and *Aphaenogaster* belong to the tribe Pheidolini Emery.

At the Ramona site the workers of *Pheidole grallipes* are most active late in the evening and on cloudy days. While insects and

other arthropods were carried into the nest by returning foragers, there was no deposit of chaff near the nest nor any other sign of seed harvesting activity although various grasses were growing nearby. *P. grallipes* would not accept bread crumbs and various seeds placed near the nest but did accept cake frosting, syrup, meat scraps, and various dead insects. Judging by the prey brought in by foraging workers the species is primarily entomophagous and is especially fond of termites. When a dead log infested with subterranean termites (*Reticulitermes* sp.) was placed near the nest great excitement reigned as soon as the termites were located, and what must have been a large portion of the colony quickly left the nest to exploit this food source. Other entomophagous *Pheidole* that I have seen behave similarly. Creighton and Gregg (1955: 36) have described the preference of *P. titanus* for termites. Termites are a favorite food of many species of ants, and a predilection for them is probably common amongst the entomaphagous species of *Pheidole*.

The prey of *Pheidole grallipes* is overcome primarily with the aid of the manidbles, since the sting is degenerate and nonfunctional in this genus. A sticky substance with a rank, fecal odor is exuded from the tip of the gaster and daubed on the prey or enemy. This odor resembles that of army ants of the genus *Neivamyrmex* Borgmeier. As is usual in the Formicidae the minor workers are more numerous and aggressive than the major workers. The workers and soldiers of *Pheidole grallipes* are very agile and run backwards and sideways readily. In combating an insect larger than themselves the workers and soldiers grasp the various appendages of the insect and pull backwards, stretching the enemy or prey and pinning it to the ground. While grasping the prey they often move the gaster up and down as if stridulating.

Pheidole workers possess a greater coordination of effort than is true of most Myrmicinae. The workers of the entomophagous species, at least, are able to carry out many of their activities and movements, such as evacuating the nest or transporting food, suddenly and in concert.

Surprisingly large pieces of food can be carried through the cooperative efforts of the workers and soldiers of *Pheidole grallipes* and related species of entomophagous *Pheidole*. Several workers will grasp the food particle with their mandibles. Of the workers carrying the particle, those which are nearest the nest run back-

wards; those bringing up the rear run forward in a more normal manner while workers assisting from the sides run sideways while grasping their burden. The food particle is frequently rotated as it is carried around obstacles so that a worker will sometimes temporarily pull in the wrong direction, but on meeting resistance from the majority of her sisters, she quickly shifts the direction of her efforts so as to conform to the general direction of movement. In this manner large fragments of food are transported rapidly along the odor-trail towards the nest.

I would like to acknowledge the help rendered by Dr. A. Earl Pritchard, Miss Alice Gray and others who read the manuscript and offered helpful suggestions.

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THE TYPE OF ABEDUS INDENTATUS (HALDEMAN)

In my recent revision of the genus *Abedus* (1960)[1] I stated that Haldeman's type of *A. indentatus* could not be found in the Academy of Natural Sciences of Philadelphia and was presumed destroyed. Recently Mr. David Eades of the Academy informed me that the type has been located, and through the cooperation of Dr. James A. G. Rehn, I have been able to study the specimen. The type agrees in all essential details with the species to which, in my revision, I had applied Haldeman's name. The type is a female and bears the labels "Calif.", and 102. The specimen is catalogued in the Academy Collection under number 9002.—Arnold S. Menke, *University of California, Davis.*

[1] Menke, A. S. 1960. A taxonomic study of the genus Abedus Stal. Univ. Calif. Publ. Ent., 16(8):393-440.

THE NEARCTIC SPECIES OF THE GENUS EURYGASTER

(Hemiptera: Pentatomidae: Scutellerinae)

SAMAD VOJDANI[1,2]

In the course of investigating the ecology of some endemic California *Eurygaster*, the problem of identification of species arose. Seven specific names existed and were dealt with by Bliven (1956) in a key. It was obvious when attempting to use this key that the characters employed were too variable. Also there were some additional characters used by Bliven in describing his five new species. Therefore, the present taxonomic study became necessary to attempt to clarify at least Bliven's species and to shed light on the systematics of Nearctic species of the genus *Eurygaster*.

The first species of North American *Eurygaster* to be described was *E. alternata* by Thomas Say in 1828. Van Duzee described *E. carinata* in 1904, but this name was changed by Kirkaldy in 1909 to *E. shoshone* since Van Duzee's specific name was a primary homonym. Many locality records were published by Van Duzee (1917) for these two species in North America mainly involving the distribution in the western States.

In 1956 the latest and last systematic work to be published on Nearctic *Eurygaster* was Bliven's descriptions of five new species: *E. greggii; E. ukiah; E. macclellani; E. amerinda* and *E. minidoka*. All of the specimens he studied were collected in northern California with the exception of a few individuals from Idaho. In his key besides the five new species he includes *E. alternata* and *E. shoshone*.

Unfortunately, the differentiating characters that Bliven used such as color and size are so variable that identification based on these features just leads to confusion. It has already been shown (Makhotin 1947; Vojdani 1954) that in *Eurygaster* homochromy and the protective coloration are common intraspecific variables. This is the reason why so many varieties have been described among the common Palearctic species (nine varieties for *E. maura*; eight for *E. austriaca*; six for *E. testudinaria* and more than six for *E. integriceps*) (Peneau 1911, Wagner 1951). Also the size of *Eurygaster* individuals, like many other insects, is very variable

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[2]The work reported in this paper is part of a research project supported by an I.C.A. appointment under Visiting Research Scientists program administered by the National Academy of Sciences of the U.S.A.

being influenced particulary by quantity and quality of the food ingested by the immature stages, *e.g.*, the lengths of *E. austriaca* 11–16 mm., *E. maura* 8–11 mm., *E. hottentata* 11–14 mm.

The relatively small number of specimens examined by Bliven, a total of 50 specimens for five species collected in five or six localities (a species for each locality), does not provide a sound basis for species characterization when based on size and color alone. Furthermore, it is evident from the key characters and illustrations used by Bliven that he had misidentified *E. shoshone* and probably *E. alternata*.

Some 700 specimens collected from many localities in California particularly in northern counties (fig. 7) and some from other western states were studied to determine the extent of the intraspecific variability.

In this series it was suspected that not only were the well known species *E. alternata* and *E. shoshone* represented but also all of Bliven's so-called species. Since an effort to separate Bliven's species from one another failed when color and size alone were used it was decided to compare the genitalia of both sexes of all individuals in the series under study. The use of these latter structures have successfully resolved the species complex in the old world (see Wagner 1951 or Vojdani 1954).

The genitalic differences found in the study series permitted segregation of four groups of specimens, and it was concluded that each of the following groups represented a species.

Group 1.=*E. alternata* Say (figs. 1 and 2)
Group 2.=*E. shoshone* Kirkaldy (figs. 1 and 2)
Group 3.=*E.* sp. C (figs. 1 and 3)
Group 4.=*E.* sp. D (figs. 1 and 3)

Groups 1 and 2 seem to fit the concepts of the two well known species *E. alternata* and *E. shoshone*, but what specific names to apply the groups 3 and 4 posed another problem, for there were five Bliven names available.

To determine where Bliven's "species" fall within the four distinct groups (species) based on genitalic differences, the only characters in Bliven's descriptions that possibly could be used were size proportions. Therefore measurements of length of body, width of abdomen and also width of thorax, the latter not included by Bliven, were made on 40 individuals of group 3 and of group 4 as well as 20 individuals of *E. alternata* and *E. shoshone*. All

individuals were randomly selected and the data were analyzed statistically. The results of this analysis are shown in Table 1 and Figures 4, 5, and 6.

The data shown in Table 1 and Figures 4 and 5 indicate clearly that the lengths and widths of four of Bliven's species, viz.. *E. greggii*, *E. macclellani*, *E. ukiah* and *E. amerinda*, were not significantly different and agree with the species group 3 designated above as *E.* sp. C., and Bliven's species *E. minidoka*

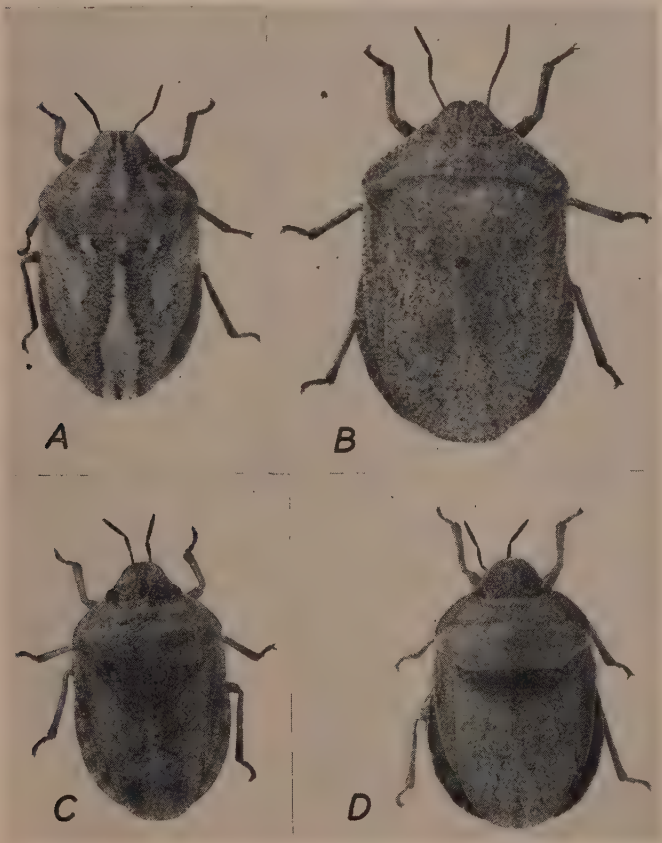

Fig. 1—General aspect of four Nearctic species of *Eurygaster*. A: *E. alternata* Say, B: *E. shoshone* Kirkaldy, C: *E. minidoka* Bliven, D: *E. amerinda* Bliven.

corresponds with the proportions of species group 4 or *E.* sp. D. The data shown in Table 1 and Figure 6 indicate that the width of the thorax is less variable than the width of the abdomen and not only supports the segregation of the above populations, but is perhaps a more useful character for the separation of these species.

It is clear that the variability of size between the sexes distinctly overlaps; therefore size cannot be used to separate sexes as Bliven believed. The structure of the last abdominal segment is the only conspicuous and reliable character for sex determination.

Therefore on the basis of genitalia and statistical analysis of

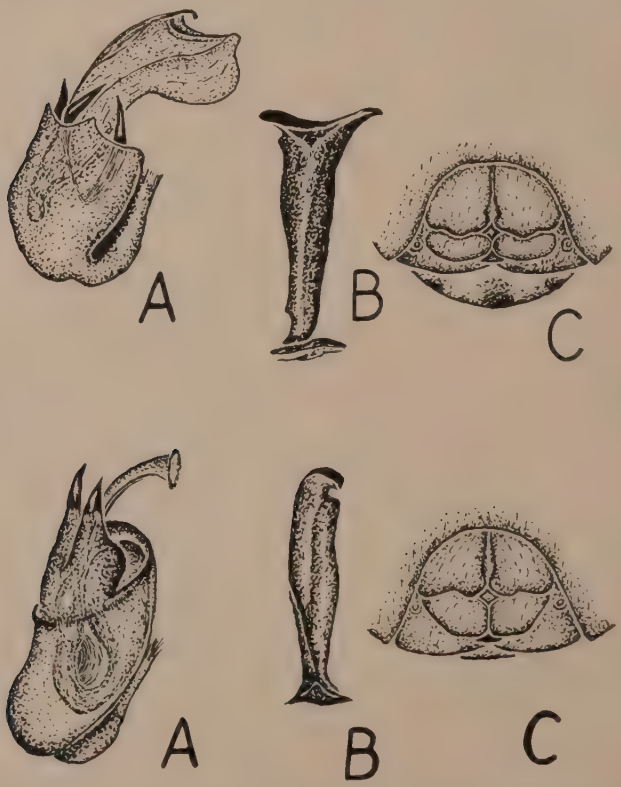

Fig. 2—Upper: *Eurygaster alternata* Say. Lower: *Eurygaster shoshone* Kirkaldy. A. ♂ Genitalia; B. ♂ Paramere; C. ♀ Genitalia.

size variability the following species of the genus *Eurygaster* occur in the Nearctic region with the new synonymy as indicated.

1. *E. alternata* Say
2. *E. shoshone* Kirkaldy
3. *E. amerinda* Bliven=*E. greggii* Bliven, *E. macclellani* Bliven, *E. ukiah* Bliven (new synonymy)
4. *E. minidoka* Bliven

Distribution. The insufficient information available at the present time permits only a sketchy outline of the distribution of the genus *Eurygaster* in the United States. The general picture however, indicates that they are fairly widespread. These bugs are

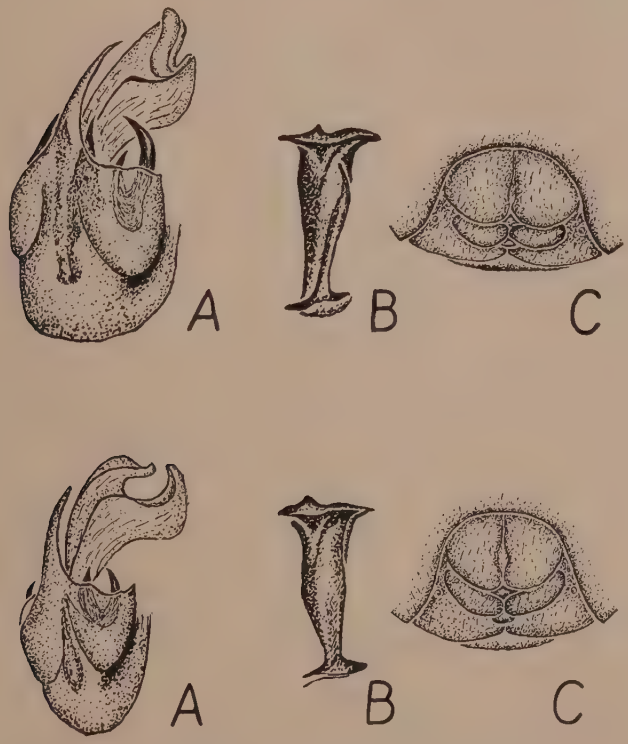

Fig. 3—Upper: *Eurygaster amerinda* Bliven. Lower: *Eurygaster minidoka* Bliven. A. ♂ Genitalia; B. ♂ Paramere; C. ♀ Genitalia.

Table 1.—Size Comparison of Four Nearctic Species of *Eurygaster* in Millimeters

Species Group	N	Length			Width At Abdomen			Width At Thorax		
		Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.
Group 1 *(E. alternata)*	20	7.3-9.0	8.3	±0.49	4.2-5.3	4.8	±0.31	4.2-5.3	4.8	±0.30
Group 2 *(E. shoshone)*	20	10.0-11.8	11.3	±0.42	6.4-7.2	6.8	±0.23	6.1-7.0	6.5	±0.24
Group 3 (*E.* sp. C)	40	8.5-9.7	9.1	±0.34	5.6-6.4	6.0	±0.21	5.2-6.0	5.7	±0.22
Group 4 (*E.* sp. D)	40	7.5-9.1	8.6	±0.36	4.5-5.5	5.2	±0.22	4.3-5.3	5.0	±0.19

associated with savanna grasslands in the mountainous ranges regardless of the altitude.

The present state records of the two earlier known species show that *E. alternata* is distributed transcontinentally chiefly across the northern part of the United States with extensions to Canada and New Mexico. This area represented by records from east to west includes Maine, New Hampshire, Massachusetts, New Jersey, New York, Michigan, Illinois, Indiana, Iowa, North

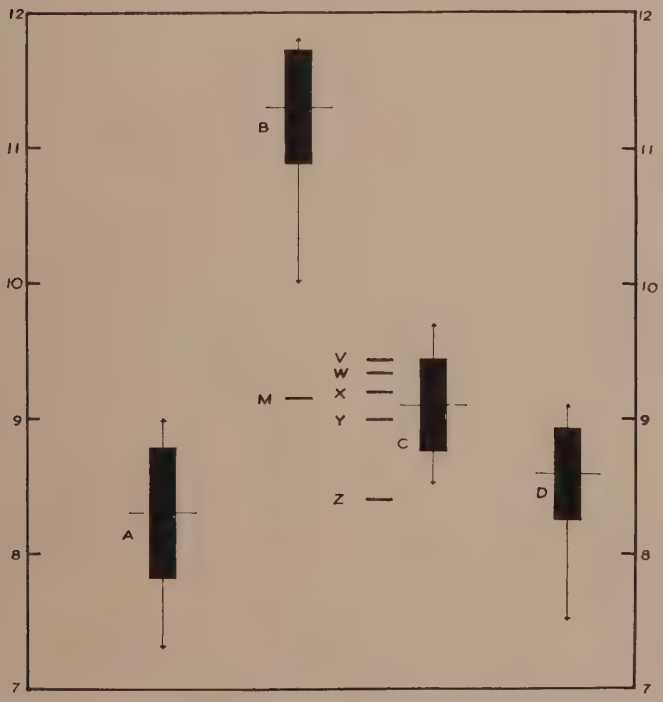

Fig. 4—Diagram showing the variability of the body length of four groups of species of *Eurygaster* compared with Bliven's species: A: *E. alternata*; B: *E. shoshone*; C: *E.* sp. C=*(E. amerinda)*; D: *E.* sp. D=*(E. minidoka)*; V: *E. amerinda*; W: *E. macclellani*; X: *E. greggii*; Y: *E. ukiah*; M: Mean of V.W.X.Y.; Z: *E. minidoka.* In each species the vertical line indicates the total observed variations; the broad portion of line one standard deviation of each side of the mean.

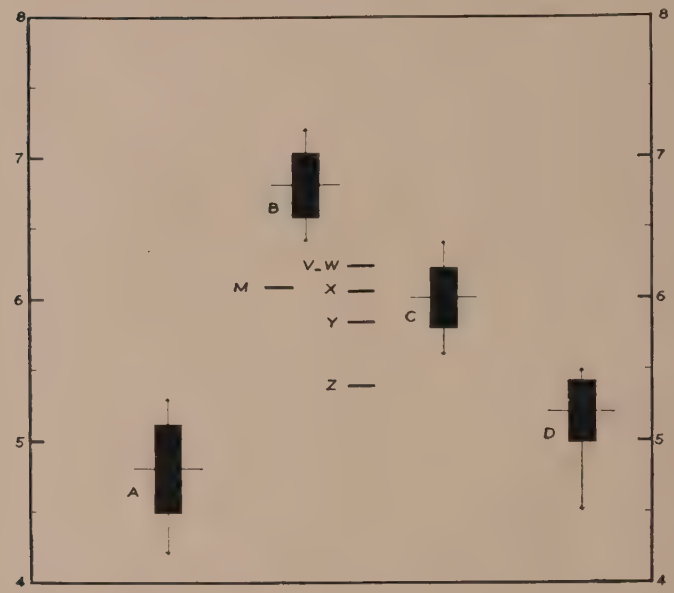

Fig. 5—Diagram showing the variability of the abdominal width of four groups of species of *Eurygaster*. (Letters and explanation as in figure 4.)

Dakota, Nebraska, Montana, Colorado, New Mexico, Utah, Nevada, and California (figure 7).

In California, *E. alternata* is relatively scarce in collections as compared to the other species. This species occurs in the northern boreal areas of the state, viz., Eagle Creek, Trinity County, Castella, Shasta County, and in the Sierra Nevada mountains, Sattley, Sierra County, Hobart Mills (Sagehen), Nevada County (figure 7).

During the past 50 years *E. shoshone* has been reported only from the western states. This western species occurs from Washington to southern California with Utah as the eastern limit. *E. shoshone* has been collected in Washington, Oregon, California, Nevada, Idaho and Utah, and is fairly rare in collections.

The available records for California show that this species tends to occupy the southcentral part of the state, particularly on the slopes of the mountains surrounding the San Joaquin Valley

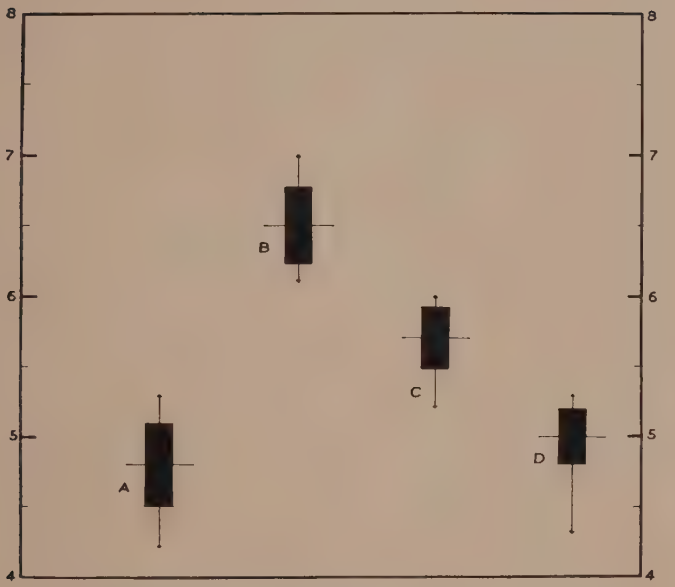

Fig. 6—Diagram showing the variability of the thoracic width of four groups of species of *Eurygaster*. (Letters and explanation as in figure 4.)

(figure 7). The following are available locality records: Randsburg, Kern County; Arvinwood Lake and Ash Mt. flume in the Sequoia National Park, Tulare County; Mt. Hamilton and Pacheco Pass in Santa Clara County; Moor Park, Ventura County; Mint Canyon and Claremont in Los Angeles County; and Panamint, Inyo County.

E. minidoka is the most common species in California, and it also has been collected in Washington, Oregon, Idaho, Nevada and Utah (figure 7). In California this species is widespread, but is found mainly in the major mountain ranges of northern and central parts of the State (figure 7).

E. amerinda is also a common species in California but has not been collected outside of this state. It is found associated with *E. minidoka* in most localities except in the San Francisco Bay Region. Here *E. amerinda* is apparently the only *Eurygaster* species represented (figure 7).

E. minidoka and perhaps *E. amerinda* will be found to have a wider distribution when further study is made of eastern specimens considering the genitalia and other specific characters. Since *E. minidoka* superficially resembles *E. alternata*, the former species may be misidentified in eastern collections.

ACKNOWLEDGMENT

During my visit in the United States many people have assisted me in many ways. I am especially indebted to the National Academy of Sciences for making possible these studies in California. I am grateful to the members of the University of California

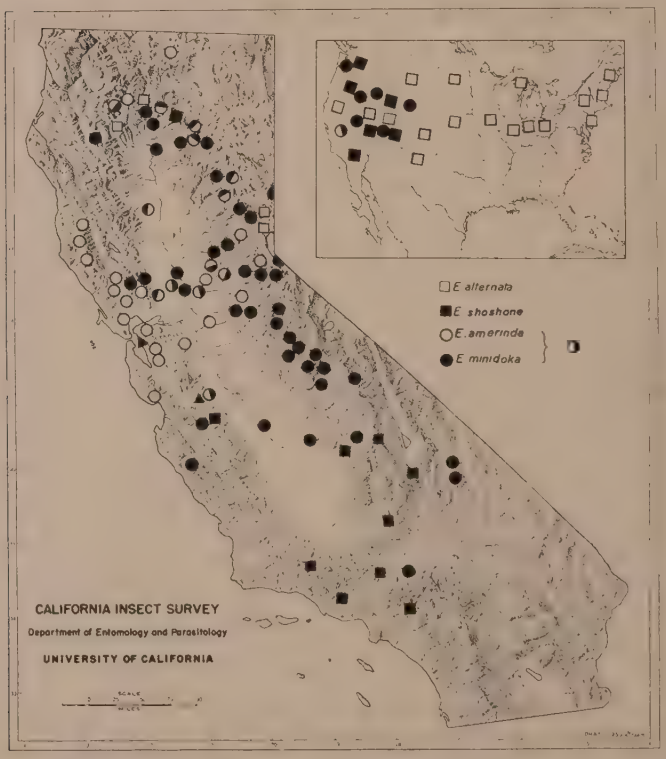

Fig. 7—Distribution of *Eurygaster* recorded up to the present time in the U.S.A. in general and in California specifically.

Department of Entomology and Parasitology and the Department of Biological Control for their kind hospitality and valuable advice. Particularly I wish to express my gratitude to Drs. R. F. Smith, K. S. Hagen, R. L. Usinger, P. D. Hurd, Jr., and to Mr. J. D. Lattin of Oregon State College, and Mr. P. D. Ashlock of the United States National Museum, Washington, D.C., who gave me the valuable information at the initiation of this study. I wish also to thank the authorities of California Academy of Sciences, Department of Entomology, University of California, Davis, and the California Insect Survey for giving me the permission to examine their collections.

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OCCURRENCE OF FORCIPOMYIA CILIATA (WINNERTZ) IN NORTH AMERICA WITH NOTES ON ITS BIOLOGY

(Diptera: Ceratopogonidae)

R. J. LAVIGNE

University of Wyoming, Laramie[1]

Forcipomyia ciliata (Winnertz) has not previously been reported from the North American continent. It has been reported from Europe (Winnertz 1852, Kieffer 1901, 1925). The larva was first described by Kieffer in 1901. Saunders (1924) reported that *F. ciliata* occurred rather sparingly near Cambridge, England. He described and figured the larval and pupal stages from specimens collected under rotting water weed raked from a mill stream. Further specimens were collected by him hibernating in the rotting stalks of potato plants on a rubbish heap and beneath the bark of a fallen branch. He further noted that this species was usually found upon rotting fungi of the Agaric and Polyporus groups. In a personal communication, Saunders (*in litt.* 1960) informed the author that he had taken larvae of *F. ciliata* in cow dung at Fort Chipewayan on Lake Athabasca, Alberta, on August 9, 1945, but was unable to rear them successfully.

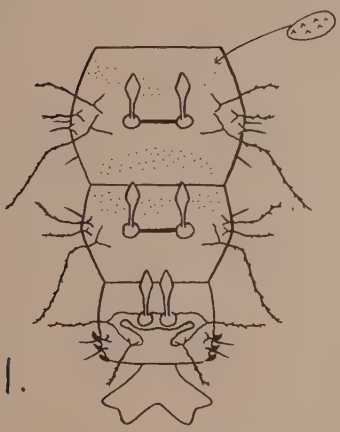
A series of 33 adults of *Forcipomyia ciliata*[2] were reared from decaying mushrooms collected in a wooded area on the campus of the University of Massachusetts in Amherst on October 2, 1958. The mushrooms were tentatively identified by the author as belonging to the Agaric group. Adults of both *Forcipomyia ciliata* and *F. pilosa* (Coquillett) were reared from decaying specimens of *Armillaria mellea* (Vahl) Quélet[3] collected from the same area on September 29. Other adult diptera reared from the same specimens of *Armillaria mellea* were as follows: *Psychoda satchelli* Quate, *Psychoda interdicta* Dyar, and *Scatopse fuscipes* Meigen.

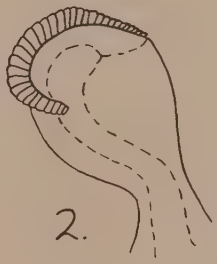
The larvae of *F. ciliata* observed by the author were collected on October 2, 1958. The decaying mushrooms in which they occurred were placed in a large glass jar and covered with a plate of glass. These larvae were noted to be quite gregarious in habit, as reported also for other larval *Forcipomyia*, occurring as a group

[1] Published with approval of the Director, Wyoming Agricultural Experiment Station as Journal Paper No. 153.

[2] Specimens of *Forcipomyia* were determined by Dr. Willis Wirth, specimens of *Psychoda* and *Scatopse* were determined by Dr. Alan Stone, both of U.S. Department of Agriculture, Washington, D.C.

[3] Determined by Dr. Howard Bigalow, University of Massachusetts, Amherst.





EXPLANATION OF FIGURES

Forcipomyia ciliata (Winnertz): Fig. 1—Seventh, eighth, and ninth abdominal segments of the larva. Fig. 2—Pupal respiratory horn.

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of approximately 60 individuals. When collected the larvae were in the third and fourth instars, stages in which they ordinarily spend the winter (Saunders, 1924). Influenced by the warm temperature of the laboratory, approximately 80°F., they quickly completed their development. They were observed to feed on the decaying fungi. In the final instar, bars appeared between each pair of spear-shaped setae on all the abdominal segments with the exception of the ninth. (See fig. 1). No bars were observed on the thoracic segments. Just before pupation, the larvae sought dry leaves upon which they attached themselves in a circle with their heads directed towards the center.

Pupation occurred soon after. The empty larval skins remained attached to the fourth and fifth abdominal segments of the pupae, as is the case with other members of this genus (Saunders, 1924). The pupal stage lasted approximately one week.

Adults first appeared on October 13 and continued to emerge until October 20. In captivity, the adults died within two to three days.

Slight differences were noted between the larvae and pupae collected by the author and those figured by Saunders (1924). The prothoracic segment and the eighth abdominal segment of the

larvae lack Saunders' lateral hair *d*. On the prothoracic segment, it has apparently been replaced by a microseta. Six pairs of setae, other than the spear-shaped setae, occur on the meso- and metathoracic segments and on the first seven abdominal segments as opposed to the five pairs figured for these segments by Saunders.

In the pupal stage, the microchaetae are not as numerous as stated for *F. ciliata* by Saunders. Saunders (*in litt.*, 1960) notes that in comparing the European and American examples of the same species, the pupal respiratory horn is the feature most likely to vary. This feature was found to be the one that showed the greatest variance. As shown in figure 2, the hexagonal sculpturing extends only about half way down the horn as opposed to Saunders' drawing showing this sculpturing to extend the entire length of the horn. The ellipsoidal areas figured by Saunders on the abdominal segments of the pupa are lacking also. In all other respects both the larvae and pupae agree with the descriptions rendered for them by Saunders.

Specimens of the larvae, pupae and adults are deposited in the U. S. National Museum, in the University of Massachusetts' collection, and in the collection of Dr. L. G. Saunders at the University of Saskatchewan, Saskatoon, Canada.

I wish to express my appreciation to Dr. Willis Wirth of the U. S. National Museum and Dr. L. G. Saunders of the University of Saskatchewan for the identification of the adults, verification of the larvae, and their helpful criticism of this paper.

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ADDITIONAL RECORDS OF TABANIDAE FROM THE WEST COAST OF SOUTH AMERICA

(Diptera)

Cornelius B. Philip[1]

The following records are based on materials collected by the California Academy of Sciences (CAS) expeditions but received too late to be included in the two previous reports (Philip, 1958, 1960). Two undescribed species, plus a third in American Museum of Natural History (AMNH) from Colombia, are described below.

Esenbeckia bella Philip, new species

(Fig. 1)

A striking, robust, reddish-brown species with midfrontal callus, orange antennae, palpi and tibiae, and prominent, longitudinal design on wings.

Female.—21 mm., wings 20 mm. *Head:* Eyes bare. Frons subparallel-sided, gently expanded below as figured, brown pollinose with narrow buff margins and a median, reddish, shield-shaped callus with tridentate upper margin. Subcallus small, concolorous with frons. Face moderately protuberant under antennae, brown, sparsely pollinose; cheeks yellow with orange beard; a narrow post-ocular rim with row of low yellow hairs. Antennae and palpi as figured, orange-haired; basal annulus broad, the apical one long, attenuated; apical palpal segment long, spatulate, reaching to base of labella, with broad lateral bare area; proboscis brown sclerotized but not thickened. *Thorax:* dull reddish-tan dorsally, unlined, with concolorous hairs, except for paler tufts below and behind the wing bases, and on squamae. Femora a little darker reddish than tibiae, mostly red-haired. Wings brown on fore margin including both basal cells and outwardly anterior to vein R_{4+5}, a prong along R_5 to margin, the apex paler; remainder of wing behind, subhyaline including all cells except extreme bases of R_5, discal, and cubital. Halteres yellow, subepaulets smoky black. *Abdomen:* enameled, mahogany red above, and black below, except sternite 1 reddish pollinose; vestiture worn middorsally, mostly brown to blackish, pale hairs across incisures of tergite 1 and sternites 2 and 3, and on outer corners of tergites 2 to 4, and sternite 4.

Holotype female, Colombia, Don Diego (100 ft.), Magdelena, May, (no year), H. H. Smith (In AMNH).

This beautiful species in its broad, sharply limited costal band, and peculiar median callus is unlike any of the other pictured-winged species known to me.

[1]U.S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, National Institute of Allergy and Infectious Diseases, Rocky Mountain Laboratory, Hamilton, Montana.

ESENBECKIA FILIPALPIS Williston

A male was taken by Ross and Michelbacher in Republic Argentina, five mi. S. Lumbreras, Salta, II-14-51. This is a new record for the State of Salta.

MYCTEROMYIA PHILIPPII Philip

Female, Chile, "E. entrance to tunnel, Aconcagua, 90 km. S. Illapel, XI-28-50, Ross and Michelbacher."

SCAPTIA (SCAPTIA) LATA (Guèrin)

Two females, Chile, Angol, I-1-50, Ross and Michelbacher; ♀, Chile, Bio-Bio, Negreto, XII-31-50, Ross and Michelbacher.

VEPRIUS ANNULICORNIS (Philippi), new combination

Male, Chile, 15 mi. S. of Los Vilos, Coquimbo, XII-13-50, Ross and Michelbacher.

ESENBECKIA ECUADORENSIS Lutz and Castro

Female, Ecuador, 20 mi. W. Guayaquil, Guayas, 100 m. I-28-55, Schlinger and Ross.

CHRYSOPS LAETA var. SUBLAETA Philip

Female, Colombia, 15 mi. S.W. of Mocoa, Narino, 1610 m., III-1-55, Schlinger and Ross.

CHRYSOPS VARIEGATA Fabricius

Three females were taken in Colombia, 40 mi. S. Cali, Valle, 1140 m., III-6-55, and two others 17 mi. W. Sevilla, Valle, III-7-55, Schlinger and Ross.

STENOTABANUS FURVUS (Hine), new combination

A female taken in Peru, 10 mi. S.W. Las Palmas, Huanuco, 1000 m., IX-17-54, Schlinger and Ross (new Peruvian record) and another in Bolivia, El Palmar, Chapare, Cochabam, IX-8/15-56, L. E. Pena (coll. L. L. Pechuman), reveal that *Stypommia maculipennis* Kröber, also from Bolivia, is a synonym. The species is darker than *Stenotabanus venosa* (Bigot) with which Fairchild (1956) had synonymized *S. maculipennis*.

DIACHLORUS BIMACULATUS (Wiedemann)

A new record for Peru is provided by a female taken at Pucalipa, X-2-54, Schlinger and Ross. The specimen has paler hind tibiae than usual and the abdomen is like some Brazilian variants in which the maculations are obsolescent.

DICHELACERA (DICHELACERA) CHOCOENSIS Fairchild and Philip

This recently described insect is represented by two females

taken in Colombia, 12 mi. S. Buenaventura, Valle, 30 m., III-27-55, Schlinger and Ross.

DASYBASIS MACULIVENTRIS (Macquart)

Ross and Michelbacher took two females of this somewhat variable Chilean species in Bio-Bio, El Ababico, XII-31-50, and one 3 mi. N. Los Vilos, Coquimbo, XII-13-50. The clouds on forks with short spurs, and on cross-veins, plus wide fronts with reddish, quadrangular callosities, often with blackish triangular discs, are distinctive. The abdominal pattern in unworn specimens resembles *D. pachnodes* (Schiner) in having brown sides and suggestions of three rows of triangles, but occasionally the abdomen is predominantly dark with lateral red obsolescent as in one Bio-Bio female.

I have previously misidentified this species as *D. shannoni* (Kröber) from several Chilean localities, and Tucuman, Argentina. Though Kröber described specimens (now destroyed) from Patagonia, the synonymy appears correct. I have seen in Paris the types of *maculiventris* discussed by Fairchild (1956).

DASYBASIS PRUINVITTATA (Kröber), new combination

The same collectors captured one female in Chile, 5 mi. N. Laguna Dam, XII-6-50, 8000 ft. This species has blackish body with pale incisures and thoracic lines, and wide front with transverse black callosity.

DASYBASIS PACHNODES (Schiner), new combination

They also took four females of this species in Chile as follows: three, 5 and 10 mi. W. La Junta, Coquimbo, XII-7-50; one, 12 mi. E. Rivadavia, Coquimbo, XII-4-50. This little gray species has three rows of pale spots on the abdomen, and wide front with quadrate brown callosity. It appears to be fairly common in parts of Chile, and has been seen from Neuquen, Argentina. On account of frequent greasing, it is often misidentified.

Dasybasis acallosus Philip, new species

(Fig. 2)

A large, blackish hairy species with entirely pollinose front, hyaline wings, and very small, slender palpi. Though the lack of frontal callosity is unusual in this genus, other species also assignable to *Dasybasis*, though with missing or only vestiges of basal callosities, have been seen from Peru and Chile.

Female.—14.5 mm. *Head:* Eyes black, unbanded, (relaxed), densely

covered with pale brown hairs. Front ash-gray pollinose with coarse brown hairs; distinctly narrowed above, index 1:2.3; a small but prominent brown tubercle just below vertex, no ocelli visible. Subcallus shallow, dark gray, with orange lunules above the bases of the antennae. Face smoky gray, covered with shaggy black and pale hairs. Antennae black, dark brown basally with black hairs, the dorsal angle of plate low, rounded. Palpi yellow with black hairs, not swollen basally, half as long as stylets. Theca and labella fleshy, black. *Thorax, abdomen:* Entire body, including notopleural lobes and scutellum, subshiny black with bushy straw-yellow hairs most prominent laterally, some inconspicuous black hairs on notum, and dorso-caudally and ventrally on the abdomen. Legs blackish, the two hind pairs of tibiae dull red; vestiture predominantly pale. Halteres sooty. R_4 without basal spur-veins. Seventh tergite extruded (perhaps abnormally) and as long as the sixth.

Holotype female: ARGENTINA, FIVE KILOMETERS WEST OF PUENTE DE INCA, MENDOZA, February 5. 1951, 1200 ft., Ross and Michelbacher (In CAS).

Two related species from Peru and Chile, which also appear to be undescribed, differ in having wider, subparallel-sided fronts, paler bushy beards and eye hairs, and shorter palpi. The Peruvian species is much smaller.

A dense covering of orange pollen on the sides and face of the type indicates plant visitation.

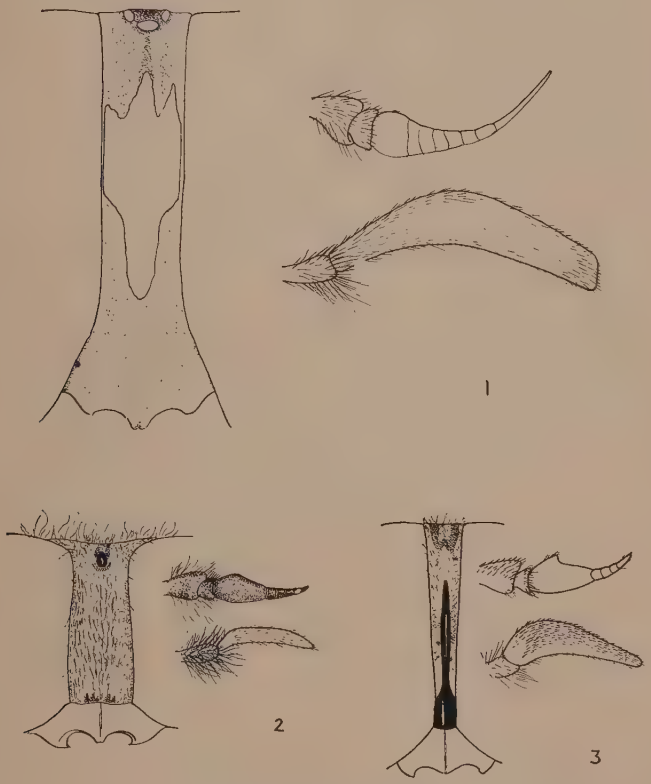
Tabanus (Lophotabanus) cyclopus Philip. new species
(Fig. 3)

A small, slender, brown-bodied species with narrow front, red antennae, bicolored fore tibiae, large ocular spot on scutellum, and a narrow, mid-dorsal yellow line on abdomen.

Female.— 13 mm. *Head:* Eyes bare, with lower purple pattern and three green bands above, the upper purple band incomplete. Front narrow, convergent below where it is filled by the small, reddish callosity with a connected, darker keel to the upper third; yellow pollinose and sparsely pilose with two separated, vertical, bare brown streaks, at vertex; index 1:9. Subcallus and upper cheeks yellow pollinose. Remainder of face, cheeks and beard whitish. Antennae entirely red, a little darkened on the apical annuli; black-haired basally; plate about a third longer than wide, and than style, gently excavated, the tooth obtuse. Palpi dirty-white with black hairs, attenuated and but little swollen basally; nearly as long as proboscis. *Thorax:* notum buff-yellow pollinose with straw-yellow hairs, with two obscure, narrow brown lines; the eye spot large, dark brown on praescutellum and scutellum, leaving the hind margins of the latter narrow gray pollinose. Pleura pink above, whitish below with concolorous hairs. Legs red with pale hairs, the fore tibiae white basally, the apical third blackish with black hairs. Halteres pale

brown. Wings clear, spur veins a little longer than stems; cells R_5 wide open. *Abdomen:* long and tapered, reddish-brown with black hairs, not paler on incisures, a narrow, middorsal yellow-haired line composed of tall truncated triangles on tergites 1 to 6; 7 blackish. Venter pale reddish with yellow hairs.

Holotype female: ECUADOR, 20 MILES WEST OF GUAYAQUIL, GUAYAS, 100 m., January 28, 1955, Schlinger and Ross (In CAS). One paratype female, same data. 15 mm. In good agreement



EXPLANATION OF FIGURES

Figs. 1–3, frons, antenna and maxillary palpus of tabanids: Fig. 1—*Esenbeckia bella* Philip; Fig. 2—*Dasybasis acallosus* Philip; Fig. 3—*Tabanus cyclopus* Philip.

but more worn so that the eye spot is obscured, and without the accompanying holotype would doubtless be assigned to subgenus *Macrocormus* on basis of the wing spurs. The median, narrow abdominal line distinguishes this from other *Lophotabanus* species known to me.

TABANUS (PHILIPOTABANUS) MAGNIFICUS Kröber

The following females were captured by Schlinger and Ross: COLOMBIA, two, 11 mi. W. Cali, Valle, 1940 m., III-23-55; seven, 12 mi. E. Buenaventura. Valle, 30 m., III-27-55. ECUADOR. six, 6 mi. E. Santo Domingo de los Colorados Pichincha. II-24-55.

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NEW HOST RECORDS FOR CHERRY FRUIT FLY IN OREGON

In the late summer of 1956, maggots of *Rhagoletis cingulata indifferens* Curran[1] were collected from the fruit of Japanese plum, *Prunus salicina* Lindl. at Hood River and Pacific plum. *P. subcordata* Benth. near The Dalles.

A number of fruits picked from a single Japanese plum tree in the residential district of Hood River contained exit holes from which larvae emerged and pupated. Oother instars were also represented in the sample.

Numerous emergence holes were found in the plums at The Dalles, and three fruit flies were observed on the fruit. Second and third instars were commonly found in the fruit next to the pit. The Pacific plum is not indigenous to the area immediately surrounding The Dalles. The six small trees adjacent to a commercial cherry orchard on the experiment station property were trial selections from the Summer Lake and Klamath Falls area of Oregon.—F. E. ELLERTSON, *Mid-Columbia Branch Experiment Station, Hood River, Oregon.*

[1] Identified by: F. L. Blanc and R. H. Foote, California State Department of Agriculture, Sacramento and U.S. National Museum, Washington, D.C., respectively.

DESCRIPTIONS OF ONAGRANDRENA ASSOCIATED WITH OENOTHERA AND CLARKIA WITH TAXONOMIC NOTES ON OTHER SPECIES

(Hymenoptera: Andrenidae)[1]

E. G. LINSLEY AND J. W. MACSWAIN[2]

University of California, Berkeley

During field studies of the ecology and behavior of North American bees which collect pollen from plants of the family Onagraceae, a number of new species of *Andrena* (subgenus *Onagrandrena*) have been encountered. Descriptions of several of these are offered at this time in order that the names may be available for use in other publications. At the same time, the opportunity is utilized to make known the results of examinations of the types of several of the earlier described species, the status of which had been uncertain.

Andrena (Onagrandrena) furva

Linsley & MacSwain, new species

Female.—Related to *A. (O.) blaisdelli* Cockerell. Integument black; hairs black, those of mesonotum short, brownish, heavily plumose. *Head* with clypeus densely punctate, without indication of a median smooth line; labrum with apical process convex, heart-shaped; vertex without a smooth area adjacent to ocelli, antennae with first flagellar segment, measured along anterior margin, shorter than second and third combined. *Mesosoma* with mesoscutum dull, moderately coarsely and densely punctate, discal punctures contiguous and sub-contiguous, interspaces reticulate, pubescence short, dense, brown, heavily plumose, with a few longer black hairs intermixed; mesoscutellum similarly punctured; mesopleura coarsely, closely punctate, the punctures shining; propodeum coarsely rugosopunctate, shining, basal enclosure somewhat irregularly rugulose, basal and median ridges predominantly longitudinal, straight, postero-lateral ridges oblique but uneven and poorly defined; wings faintly tinted with black; legs with scopa of posterior tibiae long and dense. *Metasoma* moderately slender, apical margins of terga impressed and shining, impunctate area widest in mid-dorsal area, narrowing and sharply defined laterally. Length approximately 11 mm., anterior wing 7 mm.

Male.—Unknown.

Holotype female (California Academy of Sciences, Entom-

[1] The research reported here was supported by a grant from the National Science Foundation.

[2] The authors are indebted to Peter H. Raven, Rancho Santa Ana Botanic Garden, Claremont, California, for assistance in making field collections and for providing names of the species and subspecies of *Oenothera* which reflect his own biosystematic studies. G. F. Knowlton, John A. Chemsak, Jack R. Powers, Gerald I. Stage, and Robbin W. Thorp also assisted in taking field samples and William E. Ferguson made preliminary examinations of type species of *Onagrandrena* in the Academy of Natural Sciences, Philadelphia, later confirmed by the writers.

ology), from 4.5 MILES NORTHEAST OF SANTA MARGARITA, SAN LUIS OBISPO COUNTY, CALIFORNIA, April 28, 1959, at 11 a.m. P.S.T.[3] (J. W. MacSwain). *Paratypes* (California Insect Survey, University of California, Berkeley) from the same locality as follows: one female, April 21, 1959, at 8:45 a.m. (J. A. Chemsak), one female, April 28, 1959, at 11:15 a.m. (J. W. MacSwain) and one female, May 1, 1959, at flowers of *Oenothera contorta* var. *epilobioides* (but not taking pollen) at 10:57 a.m. (J. A. Chemsak). One additional female (not designated as a paratype) was captured at Deep Creek, San Bernardino County, California, May 20, 1937 (G. C. Varley in P. H. Timberlake collection), another at Altadena, Los Angeles County, California, May 2, 1936 (C. D. Michener).

This species differs from *A. (O.) blaisdelli* by the more coarsely, densely punctate mesocutum which is clothed with shorter, more densely plumose brownish hairs and the shorter first flagellar segment of the antennae.

Andrena (Onagrandrena) raveni

Linsley & MacSwain, new species

Female.—Integument black with evanescent bluish or violaceous reflections; metasoma bright blue or violet-blue; pubescence black. *Head* with clypeus convex, moderately shining but without indication of a median impunctate line, densely, subcontinguously punctate at base, less closely toward apex where the punctures are separated by one or more diameters, labrum with apical process as long as or slightly longer than broad; vertex with a smooth area on each side of ocelli; antennae with flagellum brownish, first segment, measured along anterior margin, a little longer than second and third combined. *Mesosoma* with mesoscutum feebly shining, densely punctate, punctures mostly less than one diameter apart, surface between punctures very finely, shallowly, reticulate, areas enclosd by reticulations square-shaped; mesoscutellum finely, closely punctate; mesopleura densely punctate, the punctures coarser than those of mesoscutum; propodeum coarsely, contiguously and more or less confluently punctate, basal enclosure moderately coarsely, regularly rugose, medain and basal ridges longitudinal, postero-lateral ridges oblique; wings lightly tinted with blackish; legs with scopae of posterior tibiae long and dense. *Metasoma* moderately narrow, shining; second tergum with most discal hairs long, predominantly plumose, terga two to four with a narrow impunctate apical margin. Length approximately 11 mm., anterior wing 8.5 mm.

Male.—Integument black; metasoma bright blue or violet-blue; pubes-

[3] All times reported in this paper are Pacific Standard Time.

cence long, predominantly black, with whitish or yellowish-white hairs on vertex, on genae below mandibles, dorsum, sides and venter of thorax and on first metasomal tergum. *Head* with clypeus densely punctate; labrum with apical process broad, shining, shallowly emarginate; antennae with first segment, measured along anterior margin, a little longer than second. *Mesosoma* with mesoscutum dull, moderately closely punctate but some discal punctures separated by at least one diameter, pubescence thin, not obscuring surface, mesoscutellum a little more densely punctate, more densely clothed with long pale hairs, propodeum coarsely rugoso-punctate, basal enclosure regularly rugose, basal and median ridges longitudinal, postero-lateral ridges oblique. *Metasoma* with a narrow impunctate apical margin. Length, approximately 11 mm., anterior wing 8.5 mm.

Holotype female and allotype male (California Academy of of Sciences, Entomology) from 9.5 MILES WEST OF AUSTIN, LANDER COUNTY, NEVADA, June 7, 1959, visiting *Oenothera clavaeformis integrior,* at 8:06 a.m. and 8:29 a.m., respectively (J. W. MacSwain) and 388 paratypes (California Insect Survey, University of California, Berkeley) as follows:

Same locality and flowers; 2 females, June 6, 1959 between 9:00–9:10 a.m.; 49 females, June 6, 1959, between 3:51–6:27 p.m. (some taking pollen); 1 male and 46 females, June 7, 1959 (none with pollen); 1 female from 11 miles west of Austin, June 6, 1959, visiting *Oenothera clavaeformis integrior,* between 8:50–8:55 a.m.; 11 females from 14.5 miles west of Austin, June 6–7, 1959 visiting *Oenothera clavaeformis integrior,* between 8:30–8:45 a.m. and 7:53–9:25 a.m.; 61 females, 9.5 miles west of Austin, June 6, 1960, visiting *Oenothera clavaeformis integrior* (25 with pollen), between 4:08 and 6:16 a.m.; 55 females, same locality and flowers (4 with pollen), June 7, 1960, between 6:02 and 7:14 a.m.; 43 females, same locality and flowers (16 with pollen), June 7, 1960, between 3:54 and 5:59 p.m. (J. W. MacSwain); 16 females, 9.7 miles west of Austin, Reese River Valley, June 6, 1960, visiting *Oenothera clavaeformis integrior* (none with pollen), between 6:15 and 7:12 a.m.; 25 females same locality and flowers (12 with pollen), between 4:10 and 5:41 p.m.; 2 males, 8 females, 14.7 miles west of Austin, Reese River Valley, June 5, 1960, visiting *Oenothera clavaeformis integrior* (none with pollen), between 6:30 and 6:40 a.m.; 2 males, 8 females, same locality and flowers (2 with pollen), June 6, 1960, between 4:06 and 5:59 p.m.; 2 males, 1 female, same locality, June 5, 1960, taking nectar from *Sisymbrium altissimum* at 11:01 to 11:12 a.m. and 4:45 p.m. respectively (E. G. Linsley); 1 male, 4 females, 14.5 miles west of Austin, June 5, 1960, visiting *Oenothera clavaeformis integrior* (none with pollen); 1 male, 12 miles east of Austin, June 11, 1960, visiting *Oenothera clavaeformis integrior* (J. W. MacSwain); 2 males, 44 females, 3 miles east of Railroad Pass, Lander County, Nevada, June 7, 1960, visiting flowers of *Oenothera clavaeformis integrior* between 5:51 and 6:55 a.m.; 2 males,

1 female, 2.5 miles east of Austin Summit, Lander County, Nevada, June 6, 1960, taking nectar from *Taraxacum officinale* (E. G. Linsley).

Additional specimens (not designated as paratypes) are as follows:

One female, Umatilla, Umatilla County, Oregon, June 24, 1882; 4 females, Steamboat Springs, 10 miles south of Reno, Washoe County, Nevada, May 29, 1959, collecting pollen from *Oenothera clavaeformis cruciformis*, between 7:40–8:11 a.m. (P. H. Raven); 4 females, Reno, 10 miles south on U.S. Highway 395, Washoe County, Nevada, June 18–19, 1959, collecting pollen from *Oenothera clavaeformis cruciformis*, at 7:03 a.m., 7:09 a.m. and 6:42 a.m. (E. G. Linsley, R. W. Thorp, G. I. Stage); 2 males, 48 females, same locality and flowers (12 with pollen), June 10, 1960, between 5:42 and 7:38 a.m. (E. G. Linsley, J. W. MacSwain); 3 females, 4 miles east of Emigrant Pass, Eureka County, Nevada, June 14, 1960, visiting flowers of *Oenothera clavaeformis integrior* (all with pollen), between 6:05 and 6:35 a.m.; 1 female, 22 miles west of Emigrant Pass, June 14, 1960, visiting flowers of *Oenothera clavaeformis integrior* (without pollen), at 7:05 a.m. (J. W. MacSwain); 16 females, 28.5 miles west of Eureka, Eureka County, Nev., June 8, 1960, visiting flowers of *Oenothera clavaeformis integrior* (6 with pollen), between 6:48 and 8:02 a.m. (E. G. Linsley and J. W. MacSwain); 9 females, same locality and date, visiting flowers of *Stanleya pinnata* (none with pollen), between 7:27 and 8:45 a.m. (J. W. MacSwain); 34 females, same locality, June 9, 1960, visiting flowers of *Oenothera clavaeformis integrior* (18 with pollen), between 6:20 and 8:58 a.m. (E. G. Linsley, J. W. MacSwain); 5 females, same locality and date, visiting flowers of *Stanleya pinnata* (none with pollen), between 7:25 and 8:45 a.m.; 5 females, same locality, June 11, 1960, visiting flowers of *Oenothera clavaeformis integrior* (1 with pollen), between 4:33 and 5:54 p.m. (J. W. MacSwain); 3 females, 33.8 miles west of Eureka, June 7, 1960, visiting flowers of *Oenothera clavaeformis integrior* (1 with pollen in the afternoon), 1 at 10:10 a.m. and 2 between 4:05 and 4:08 p.m., (E. G. Linsley, J. W. MacSwain); 7 females, 36.2 miles west of Eureka, June 7, 1960, visiting flowers of *Oenothera clavaeformis integrior* (5 with pollen), between 3:38 and 3:45 p.m. (E. G. Linsley); 2 females, 37 miles west of Eureka, June 7, 1960, visiting flowers of *Oenothera clavaeformis integrior* (none with pollen), between 3:47 and 3:48 p.m. (J. W. MacSwain); 7 females, same locality, June 8, 1960, visiting flowers of *Oenothera clavaeformis integrior* (1 with pollen), between 7:12 and 7:24 a.m. (E. G. Linsley); 5 females, 7.6 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (2 with pollen), between 5:45 and 5:55 a.m.; 8 females, 17.1 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (none with pollen), between 6:05 and 6:15 a.m.; 5 females, 50.2 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (2 with pollen), between 6:55 and 7:00 a.m.; 1 female, 70.8 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (without pollen), between 7:15 and

7:30 a.m.; 4 females, 73.3 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (2 with pollen), between 7:30 and 7:45 a.m.; 1 female, 2 males, 28.5 miles west of Eureka, Eurkea County, Nevada, June 7, 1959, visiting *Oenothera clavaeformis integrior,* between 11:30 a.m. and 12:00 noon; 1 female, 3.6 miles south of Tooele, Tooele County, Utah, June 16, 1959, visiting *Oenothera latifolia* (J. W. MacSwain); 1 female, 3.5 miles south of Ravendale, Lassen County, California, June 20, 1959, visiting *Oenothera tanacetifolia* at 7:12 a.m. (G. I. Stage); 21 females, 6.5 miles north of Termo, Lassen County, California, June 21, 1959, taking pollen from *Oenothera tanacetifolia* between 6:34–8:24 a.m. (G. I. Stage); and 17 females, 0.5 miles north of Madeline, Lassen County, California, June 21, 1959, taking pollen from *Oenothera tanacetifolia* between 6:34–7:59 a.m. (R. W. Thorp); 2 females, June 9, 1960, visiting flowers of *Oenothera tanacetifolia* (2 with pollen), between 8:47 and 9:56 a.m.; 1 male, 1 female, same locality, date and flowers at 7:31 a.m. and 1:40 p.m. respectively (without pollen); 1 female, same locality and date, visiting flowers of *Madia ramii* for nectar at 10:34 a.m.; 2 males, same locality and date, 1 cruising bush at 9:12 a.m., the other visiting *Agoseris glauca* for nectar between 11:10 and 11:20 a.m.; 1 female, same locality, June 11, 1960, visiting flowers of *Oenothera tanacetifolia* (with pollen), at 8:29 a.m.; 1 female, 2 miles north of Ravendale, Lassen County, California, June 10, 1960, on ground at 7:46 a.m. (G. I. Stage); and 4 females, 5.5 miles north of Termo, June 23, 1960, visiting flowers of *Oenothera tanacetifolia* (1 with pollen), between 6:58 and 8:12 a.m. (J. W. MacSwain).

This species differs at once from other members of the *oenotherae* complex by the blue coloration of the abdomen in both sexes. It can also be differentiated by having the produced apex of the labrum short, not or scarcely longer than wide. Also, the mesoscutum is feebly shining and the surface between the punctures is very finely, shallowly reticulate with the network being composed of square-shaped enclosures.

Andrena (Onagrandrena) chylismiae

Linsley & MacSwain, new species

Female.—Integument black; pubescence black. *Head* with clypeus convex, densely punctate, without indication of a median longitudinal smooth line; labrum with apical process narrow, parallel-sided, longer than broad; vertex punctate between ocelli and compound eyes; antennae with first flagellar segment, measured along anterior margin, as long as second and third combined, flagellar segments black. *Mesosoma* with mesoscutum opaque, closely punctate, punctures mostly less than a diameter apart, interspaces finely resticulate, areas enclosed by reticulations subcircular, distinctly impressed; mesoscutellum closely punctate; mesopleura a little more coarsely, densely punctate than mesoscutum; propodeum coarsely, subcontiguously, reticulate-punctate, basal enclosure very coarsely,

irregularly rugose, wings lightly tinted with blackish; legs with scopae of posterior tibiae moderately long, subequal to width of tibiae, and moderately dense. *Metasoma* broad; second tergum with most anterior hairs long, predominantly plumose, surface moderately coarsely punctured, most punctures separated by from one to three diameters, terga two to four without a broad, apical impunctate band, apical impressed margin densely punctate. Length approximately 13.5 mm., anterior wing 10 mm.

Male.—Integument black; pubescence entirely black. *Head* with clypeus moderately, coarsely, densely punctate; labrum with process emarginate, bilobed; antennae with flagellum black, first segment about as long as second. *Mesosoma* with mesoscutum opaque, very densely punctate and reticulate, pubescence thin; not concealing surface; mesoscutellum densely clothed with very long, erect hairs, propodeum sculptured much as in the female, enclosed area coarsely, somewhat regularly, longitudinally rugose. *Metasoma* with a narrow impunctate margin on terga two to five, length approximately 11 mm., anterior wing, 9 mm.

Holotype female (California Academy of Sciences, Entomology) from STEAMBOAT SPRINGS, 10 MILES SOUTH OF RENO, WASHOE COUNTY, NEVADA, May 29, 1959, at flowers of *Oenothera clavaeformis cruciformis* at 7:44 a.m. (P. H. Raven), *allotype* male (California Academy of Sciences, Entomology), same locality, June 10, 1960, at flowers of *Oenothera clavaeformis cruciformis* at 7:30 a.m. (E. G. Linsley), and 206 paratypes (California Insect Survey, University of California, Berkeley) as follows:

Nine females from Steamboat Springs, 10 miles south of Reno, Washoe County, Nevada, May 29, 1959, collecting pollen from *Oenothera clavaeformis cruciformis* between 7:20–8:28 a.m. (P. H. Raven); 7 females, Reno, 10 miles south on U.S. Highway 395, Washoe County, Nevada, June 18, 1959, visiting flowers of *Oenothera clavaeformis cruciformis* between 6:40 a.m. and 7:44 a.m. (E. G. Linsley, R. W. Thorp); 31 females, same locality, June 10, 1960, visiting flowers of *Oenothera clavaeformis cruciformis* (15 with pollen), between 5:40 and 7:40 a.m. (E. G. Linsley, J. W. MacSwain); 5 males, Big Pine Creek, Inyo County, California, elevation 8000 feet, May 19, 1947 (R. M. Bohart); 3 males, 28.5 miles west of Eureka, Eureka County, Nevada, June 7, 1959, visiting *Oenothera clavaeformis integrior* between 11:30 a.m. and 12:15 p.m. (J. W. MacSwain); 8 females 9.5 miles west of Austin, Lander County, Nevada, June 6–7, 1959, visiting flowers of *Oenothera clavaeformis integrior* at 9:00–9:10 a.m. and between 8:22–8:59 a.m.; 21 females, same locality and flowers, June 7, 1960 (10 with pollen), between 5:18 and 7:10 p.m. (J. W. MacSwain); 5 females, Reese River Valley, 9.7 miles west of Austin, June 6, 1960, visiting flowers of *Oenothera clavaeformis integrior* (4 with pollen), between 5:46 and 7:08 a.m.; 1 male, Reese River Valley, 14.7 miles west of Austin, June 5, 1960 at flowers of *Sisymbrium altissimum* at 4:44 p.m.; 7 females,

3 miles east of Railroad Pass, Lander County, Nevada, June 7, 1960, visiting flowers of *Oenothera clavaeformis integrior* (without pollen), between 5:59 and 6:55 a.m.; 2 males, 2.5 miles east of Austin, Lander County, Nevada, June 6, 1960, visiting flowers of *Taraxacum officinale* (E. G. Linsley); 1 female, 12 miles east of Austin, June 11, 1960, visiting flowers of *Oenothera clavaeformis integrior* (J. W. MacSwain); 26 females, 28.5 miles west of Eureka, Eureka County, Nevada, June 8, 1960, visiting flowers of *Oenothera clavaeformis integrior* (16 with pollen), between 6:48 and 8:15 a.m.; 19 females, same locality and date, visiting flowers of *Stanleya pinnata* (without pollen) between 7:27 and 9:17 a.m. (E. G. Linsley, J. W. MacSwain); 1 male, same locality and date, visiting flowers of *Haplopappus acaulis*, at 9:00 a.m. (E. G. Linsley); 42 females, same locality, June 9, 1960, visiting flowers of *Oenothera clavaeformis integrior* (35 with pollen), between 5:37 and 9:03 a.m. (E. G. Linsley, J. W. MacSwain); 7 females, same locality and date, visiting flowers of *Stanleya pinnata* (without pollen), between 7:08 and 8:05 a.m.; 2 females, 7.6 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (without pollen), between 5:45 and 5:55 a.m.; 1 female, 17.1 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (without pollen), between 6:05 and 6:15 a.m.; 1 female, 50.2 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (without pollen), between 6:55 and 7:00 a.m.; 4 females, 73.3 miles north of Eureka, June 13, 1960, visiting flowers of *Oenothera clavaeformis integrior* (without pollen), between 7:30 and 7:45 a.m.; 3 females, 4 miles east of Emigrant Pass, Eureka County, Nevada, June 14, 1960, visiting flowers of *Oenothera clavaeformis integrior* (2 with pollen), between 6:05 and 6:35 a.m. (J. W. MacSwain).

This species is apparently related to the following, but females of the two may be readily distinguished by the sculpturing of the propodeal enclosure and the punctation of the second metasomal tergite. The male differs from all others known to us in the wholly black pubescence.

Andrena (Onagrandrena) vespertina

Linsley & MacSwain new species

Female.—Integument black; pubescence black. *Head* with clypeus convex, densely punctate, without indication of a median longitudinal smooth line; labrum with apical process narrow, parallel-sided, distinctly longer than broad; vertex punctate between ocelli and compound eyes; antennae with first flagellar segment, measured along anterior margin, as long as second and third combined, flagellar segments, except the first, reddish-brown. *Mesosoma* with mesoscutum dullish, finely and closely punctured, punctures mostly less than a diameter apart, interspaces finely reticulate, areas enclosed by reticulations elongate, narrowly impressed; mesoscutellum closely punctate; mesopleura a little more coarsely, densely

punctate than mesoscutum; propodeum coarsely, subcontiguously, reticulate-punctate, basal enclosure finely, longitudinally, and only slightly obliquely rugose, the median ridges more prominent; wings lightly tinted with blackish; legs with scopae of posterior tibiae moderately long (width of tibiae) and moderately dense. *Metasoma* moderately broad, shining, second tergum with most anterior hairs long, predominantly plumose, surface finely punctate, most punctures separated by at least three to five diameters, terga two to four without a broad, apical impunctate band, apical impressed margin shining but distinctly, though finely and sparsely, punctured. Length approximately 12.5 mm., anterior wing 9.5 mm.

Male.—Integument black; pubescence of anterior margin and sides of clypeus, genae behind mandibles, and dorsum of thorax yellowish-white, a few pale hairs on first metasomal tergite, elsewhere black. *Head* with clypeus moderately densely punctate; labrum with process emarginate, bilobed; antennae with flagellum black, first segment about as long as second. *Mesosoma* with mesoscutum dull, moderately closely punctate, pubescence thin, not concealing surface; mesoscutellum densely clothed with very long, erect, yellowish-white hairs; propodeum sculptured much as in the female, enclosed area finely and more or less longitudinally rugulose. *Metasoma* with a narrow impunctate margin on terga two to five. Length approximately 10.5 mm., anterior wing 8 mm.

Holotype female (California Academy of Sciences, Entomology) from 18 miles east of Bakersfield, Kern County, California, April 19, 1958, collecting pollen from *Oenothera decorticans decorticans* between 5:07 and 5:17 p.m., (E. G. Linsley), *allotype* male, same locality, March 9, 1959, taking nectar from *Isomerus arborea* between 9:30 and 11:45 a.m., (R. W. Thorp), and 121 paratypes (California Insect Survey, University of California, Berkeley), all from the same locality, as follows:

Five males, 3 females, March 28, 1953 (J. W. MacSwain); 20 females, April 19, 1958, collecting pollen from *Oenothera decorticans decorticans* between 5:13 and 5:35 p.m. (E. G. Linsley, J. W. MacSwain); 20 males, 2 females, March 9, 1959 (J. W. MacSwain, R. W. Thorp); 4 males, 6 females, March 27–28 and April 2, 1959 (E. G. Linsley, J. W. MacSwain, J. R. Powers, G. I. Stage, R. W. Thorp); 1 female, March 11, 1960 (collecting pollen from *Oenothera dentata* var. *parishii*), at 9:41 a.m. (E. G. Linsley); 16 females, March 12, 1960 (5 with pollen from *Oenothera dentata parishii*, 11 from burrows), between 7:29 and 8:00 a.m. (E. G. Linsley, J. W. MacSwain); 1 female, March 18, 1960, at 6:00 p.m. (J. W. MacSwain); 27 males, March 20, 1960 (cruising bushes), between 7:50 and 8:00 a.m., and 9:05 and 9:10 a.m. (E. G. Linsley, J. W. MacSwain); 1 female, March 20, 1960, visiting flowers of *Oenothera dentata* var. *parishii* (without pollen) at 7:12 a.m. (J. W. MacSwain); 2 males, March 29, 1960, cruising flowers of *Oenothera decorticans decorticans* at 4:12 p.m.; 15 females, March 29, 1960, visiting flowers of *Oenothera decorticans decorticans*

(7 with pollen) between 4:31 and 5:19 p.m. (E. G. Linsley, J. W. MacSwain); 1 male, March 30, 1960, sleeping; 1 male, April 2, 1960, visiting composite (J. W. MacSwain); 5 females, April 2, 1960, 3 visiting flowers of *Oenothera decorticans decorticans* (3 with pollen) between 5:08 and 5:22 p.m. (E. G. Linsley, J. W. MacSwain); 1 female, April 9, 1960, visiting flowers of *Oenothera dentata* var. *parishii* (without pollen) at 6:50 a.m. (E. G. Linsley). Two stylopized females, from the same locality in 1959, are not included in the type series.

This species superficially resembles *A. (O.) oenotherae* which occurs at the same locality but gathers pollen only in the morning from *Oenothera* of a different species group. The two differ in the form of the labral process and the somewhat denser black thoracic pubescence of *vespertina*.

Andrena (Onagrandrena) nevadae

Linsley & MacSwain, new species

Female.—Integument black; pubescence black. *Head* with clypeus shining, discal punctures mostly separated by one or more diameters; labrum with produced apex of process tumid, not longer than broad; antennae with first flagellar segment, measured along anterior margin, a little shorter than second and third segments combined. *Mesosoma* with mesoscutum slightly shining, surface between punctures very finely and obscurely reticulate, most discal punctures separated by less than one diameter, pubescence moderately long, erect, not obscuring surface; mesoscutellum more densely punctate; propodeum coarsely rugoso-punctate, basal enclosure somewhat irregularly rugose, but with median longitudinal ridge and an anterior ridge curving in toward it from the base on each side, peripheral ridges short, oblique; wings tinted with blackish; legs with scopae of posterior tibiae very long (almost twice width of tibiae), thin and loose. *Metasoma* moderately robust, apical impression of first tergum more densely punctate than disk, the punctures subequal in size, terga of metasomal segments two to four uniformly punctate except for a very narrow posterior margin in apical impression, pubescence long, plumose throughout, appressed dorsally, suberect laterally, the longest hairs on second tergum nearly one-third as long as segment. Length approximately 14.5 mm., anterior wing 10.5 mm.

Male.—Unknown.

Holotype female (California Academy of Sciences, Entomology), from 1.8 MILES WEST OF PANCAKE SUMMIT, WHITE PINE COUNTY, NEVADA, June 24, 1959, at flowers of *Oenothera clavaeformis integrior*; and one paratype female (California Insect Survey, University of California, Berkeley), from 28.5 miles west of Eureka County, Nevada, visiting flowers of *Stanleya pinnata* (without pollen) between 7:27 and 7:30 a.m. (J. W. MacSwain).

This species may be compared with *A. oenotherae* but differs

from it in the sculpturing of the propodeal enclosure, more shining mesoscutum, much larger tibial scopa which is about twice as wide as the tibia, and the very long abdominal pubescence. It is more closely related to *A. anograe,* but may be distinguished by the more shining mesoscutum and the absence of pale thoracic hairs. Like *anograe* and *linsleyi* it has a long thin scopa and is presumably associated with one of the large, white evening-primroses of the subgenus, *Pachylophis* or *Anogra.*

Andrena (Onagrandrena) anograe knowltoni
Linsley & MacSwain, new subspecies

Female.—Integument black; pubescence black. *Head* with clypeus shining, discal punctures mostly separated by one or more diameters; labrum with produced apex of process tumid, broader than long; antennae with first flagellar segment, measured along anterior margin, a little shorter than second and third segments combined. *Mesosoma* with mesoscutum dull, distinctly reticulate between the punctures, most discal punctures separated by one diameter or less, pubescence moderately long, erect, not obscuring surface; mesoscutellum more densely punctate; propodeum coarsely rugoso-punctate, basal enclosure somewhat irregularly rugose, but with a median longitudinal ridge and an anterior ridge curving in toward it from the base on each side, peripheral ridges short, oblique; wings tinted with blackish; legs with scopae of posterior tibiae almost twice as wide as tibiae. *Metasoma* moderately robust, apical impression of first tergum more densely punctured than disk but punctures much smaller, terga of metasomal segments two to four uniformly punctate without a narrow impunctate margin in apical impression, pubescence long, plumose throughout, the longest hairs of second tergum more than one-third as long as segment. Length approximately 15 mm., anterior wing 11 mm.

Male.—Unknown.

Holotype female (California Academy of Sciences, Entomology) from 5 MILES SOUTH OF GREEN RIVER, EMERY COUNTY, UTAH, May 24, 1960, visiting flowers of *Stanleya pinnata* (G. F. Knowlton); and 23 paratypes (California Insect Survey, University of California, Berkeley) as follows: 4 females, same data as holotype; 1 female from 10 miles north of Green River, May 29, 1959, at flowers of *Stanleya pinnata*; 9 females, Green River, May 24, 1960, visiting flowers of *Stanleya pinnata* between 6:00 and 6:15 a.m. (G. F. Knowlton); 1 female from the east foot of Red Plateau, Emery County, Utah, June 5, 1958, at flowers of *Oenothera scapoidea scapoidea* (a few pollen grains on body hairs) (P. H. Raven); 8 females, Crescent Junction, Grand

County, Utah. May 24, 1960, visiting *Stanleya pinnata* (G. F. Knowlton).

This form is morphologically similar to the nomino-typical subspecies but averages slightly larger and differs markedly in the color of the pubescence. The type has all black pubescence as do five of the paratypes. In the remaining paratypes there is a variation from a few pale fulvous hairs on the mesoscutum to predominantly pale with a few pale hairs on the vertex of the head and on the first metasomal tergum. The pubescence of the mesoscutum is entirely ochraceous to reddish brown in the nomino-typical form and is more extensive on the head and metasomal terga.

ANDRENA (ONAGRANDRENA) OMNINIGRA Viereck

Andrena (Andrena) omninigra Viereck 1917, Trans. Amer. Ent. Soc., 43:385, ♀.

Andrena grundeli Linsley, 1938, Proc. Calif. Acad. Sci., (4) 23:274, ♀ ♂. *New synonymy.*

An examination of the type of *A. (A.) omninigra* Viereck has revealed that it represents the species subsequently described as *A. grundeli* Linsley. The type is in poor condition being broken and partly devoured by museum pests, but the characters to which we attach the most taxonomic significance are mostly evident and there can be little doubt of the synonymy.

Andrena (Onagrandrena) omninigra clarkiae
Linsley & MacSwain, new subspecies

Female.—Morphologically similar to the nominotypical subspecies but smaller (range in length of forewing, 9.0–10.3 mm., average of 17 specimens, 9.7 mm., as against a range from 10.5–11 mm. and average of 10.7 in 10 specimens in *o. omninigra*).

Male.—Morphologically similar to the nominotypical subspecies but apparently smaller (range in length of forewing 7.8–8.5 mm., average of 18 specimens, 8.2; the only male of *o. omninigra* available for comparison, 9.8), with an indistinct transverse band of dark hairs across the thorax (only a few scattered dark hairs in *o. omninigra*), and with the white hairs of the abdomen limited to the first metasomal segment (rarely on second, also) rather than on all segments.

Holotype female and allotype male (California Academy of Science, Entomology), ARROYO SECO, MONTEREY COUNTY, CALIFORNIA, May 21, 1955 (P. Torchio). Paratypes, 67 ♀♀ and 52 ♂♂, from the type locality on various dates from May 3 to June 6, between 1955 and 1958 (R. C. Bechtel, R. M. Bohart, D. J. Burdick, D. D. Linsdale, E. G. Linsley, J. W. MacSwain, A. E.

Menke, D. Ribble, L. A. Stange, and P. Torchio). All females with pollen had been working flowers of *Clarkia*.

Andrena (Onagrandrena) bernardina Linsley

Andrena bernardina Linsley, 1938. Proc. Calif. Acad. Sci. (4) 23:275, ♀ ♂.
Andrena grundeli bernardina, Linsley and MacSwain, 1955, Pan-Pacific Ent., 31 (4):166.

The study of fresh material reveals that this is a distinct species, not subspecifically related to *A. (O.) omninigra (grundeli)* as we had at one time supposed. The females differ as follows:

Disk of mesoscutum coarsely, subcontiguously punctate, with the pubescence uniform, shorter than width of flagellum, densely plumose; wings very dark black ..... *omninigra*
Disk of mesoscutum moderately coarsely punctate, the punctures distinctly separated, and the pubescence composed of long and short hairs intermixed, the length of the longer hairs greater than width of the flagellum, the hairs only moderately plumose; wings dark brownish ..... *bernardina*

The males differ in the color of the facial hairs, those of *bernardina* being predominantly black, those of *omninigra* predominantly white. Both species apparently gather their pollen from *Clarkia*.

Andrena (Onagrandrena?) yumorum Viereck

Andrena (Andrena) yumorum Viereck, 1916, Proc. Acad. Nat. Sci. Philadelphia, 68:585, ♂.

The subgeneric position of this species has been uncertain and Lanham (1949) left it unassigned. Based upon an examination of the type, we regard it as very possibly *Onagrandrena*, although the discovery of the female will probably be necessary to settle the question. The unique male is larger than any of those now assigned to the subgenus. The ground color is as in *A. (O.) rubrotincta* Linsley. The mesoscutum is closely punctate (the punctures separated by less than one diameter), with an almost transverse black band of hairs. The propodeal enclosure is coarsely and more or less regularly, longitudinally rugose. The abdominal pubescence is moderately dense and long, as in the male of *A. (O.) oenotherae* Timberlake, the segments have a narrow impunctate apical margin, most of the discal punctures being separated by one diameter or less. The length ratio of the first and second antennal flagellar segments is as 9:7. Although Viereck named this species "*yumorum*," there is no data on the

type specimen to indicate the precise area from which it came. The original publication cites the type locality as "California (Norton)."

ANDRENA STICTIGASTRA Viereck

Andrena (Andrena) stictigastra Viereck, 1916, Proc. Acad. Nat. Sci., Philadelphia, 68:579, ♀.

Andrena (Onagrandrena?) stictigastra, Linsley and MacSwain, 1956, Pan-Pacific Ent., 32(3):114.

This species was questionably referred to *Onagrandrena* on the basis of the black coloration, coarsely rugose enclosure of the propodeum, and certain other characters reported in the original description. However, an examination of the type revealed that the tibial scopa is much denser than in *Onagrandrena,* with the hair very densely plumose and unsuited for gathering pollen from Onagraceous flowers. We therefore exclude it from this subgenus as currently defined.

ANDRENA PHENAX Cockerell

Andrena phenax Cockerell, 1898, Trans. Amer. Ent. Soc., 25:188, ♀.

Andrena (Onagrandrena?) phenax, Linsley and MacSwain, 1956, Pan-Pacific Ent., 32(3):113.

This species, also doubtfully referred to *Onagrandrena* because of the black coloration and tessellate surface of the mesoscutum, is also excluded on the basis of an examination of the type. The scopa is plumose and moderately dense with the hairs bent but not recurved.

ANDRENA (MELANDRENA) PRIMA Casad

Andrena prima Casad, 1896, Ann. Mag. Nat. Hist., (6) 18:78.

Andrena (Melandrena) prima, Lanham, 1949, Univ. Calif. Publ. Ent., 8(5):221.

Andrena (Onagrandrena) prima, Linsley and MacSwain, 1956, Pan-Pacific Ent., 32(3):112.

When *Onagrandrena* was proposed for the majority of the species assigned by Lanham to the subgenus *Melandrena* (type *Andrena morio* Brullé), *Andrena prima* Casad was assumed to fall in the former group on the basis of the original description. However, examination of the type showed that its characters are more similar to those of *A. (Melandrena) nigra* Provancher. The tibial scopia is made up of dense, short, depressed, plumose hairs and the mesonotal pubescence is short and dense as in *A. nigra.* The propodeal enclosure is well defined but somewhat smaller than in *Onagrandrena*

ANDRENA (DIANDRENA) FOXII Cockerell

Andrena foxii Cockerell, 1898, Trans. Amer. Ent. Soc., 25:188, ♀ ♂.
Andrena (Diandrena) foxii, Lanham, 1949, Univ. Calif. Publ. Ent., 8(5):219: Linsley, 1951, U. S. Dept. Agr. Monogr., 2:1065.
Andrena (Onagrandrena) foxii Linsley and MacSwain, 1956, Pan-Pacific Ent., 32(3):113.

The anomalous characters of this species are shared to some extent with both *Diandrena* and *Onagrandrena*. However, a restudy based upon a long series of fresh specimens of both sexes suggests that the greater weight should be given to the nature of the integumental sculpturing and the presence of only two submarginal cells. We propose to return it to *Diandrena* where it was assigned by Lanham (1949) and Linsely (1951).

EXOMALOPSIS ALBICANS (PROVANCHER), A NEW GENERIC RECORD FROM OREGON[1]

(Hymenoptera: Anthophoridae)

The genus *Exomalopsis* is essentially neotropical, extending from Argentina in the south, to the southern and southwestern portion of the United States in the north. Of the 27 species found in the arid regions of the southwestern United States, one, *E. albicans* (Provancher), has been recorded as far north as Middletown, Lake County, California.

Recently, eight specimens of *E. albicans* from Oregon were found among the material in the Oregon State University collections. The records, which extend the known northern limit of this species and the genus, by over 500 miles, include: one female, Murphy, Josephine County, July 22, 1941 (J. D. Vertrees); and seven females, six mi. W. Bly, Klamath County, August 18, 1955 (W. P. Stephen).

Examination of the Oregon material indicates that the Josephine County female is nearly identical with the typical California *E. albicans*. The Klamath County females, however, have considerably less white pile on the apical half of metasomal terga 2 to 4 and lack the distinct demarkation between the black pile of the base and the white pile on the apex of each of these terga. —W. P. STEPHEN AND P. F. TORCHIO, *Oregon State College, Corvallis.*

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NOTES ON A CERAMBYCID ANEFLOMORPHA CITRANA CHEMSAK. CAUSING INJURY TO ORANGE TREES IN ARIZONA[1]

(Coleoptera)

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Early in the summer of 1956, Dr. R. H. Hilgeman, Superintendent of The University of Arizona Citrus Experiment Station, Tempe, Arizona, called to the writer's attention a dying back of small branches on trees in plantings of navel and Valencia oranges. An examination of several of these dying branches showed they were infested with a small cerambycid larva which had girdled the branch.

Small dead branches were first noticed during November 1955. The following May and June other infestations were observed in the same plantings. Larvae examined at this time appeared to be about three-fourths grown. Several infested branches, (Fig. 1), were collected and placed in cages in the laboratory for observation. In early August, adult beetles emerged from these branches.

Periodic observations made in the field indicate that the young larvae, after emerging from the egg, begin to feed in the small branches. They appear to feed in such a manner as to cause complete girdling within a few weeks. It is at this stage that the dying branches are first noticed. After the branch has been girdled, the larva begins to feed toward the distal end of the branch. In some instances the larva consumes the woody part of the lateral twigs leaving mere shells of bark. The larva then returns to the main branch and continues feeding toward the distal end until development of the larva is complete. Figure 2 shows a nearly-mature larva feeding in a branch approximately ¼ inch in diameter. Usually larvae of this cerambycid infest branches of ¼ inch or less in diameter. However, in 1957–59 branches up to ⅝ inch diameter were found to have been infested. Only one larva has been found in each branch.

In June 1959 dying branches again were observed in the same block of orange trees. Eleven branches suspected of being infested were caged and periodic checks made for insect emergence. An examination of the cages in early August revealed five cages with

[1]Paper No. 582 University of Arizona Agricultural Experiment Station.

newly emerged adults. A check, in early November 1959, of the remaining six caged branches showed no emergence. No beetles were found when the same cages were again checked in December 1959. Of the six caged branches from which there was no emer-

EXPLANATION OF FIGURES

Fig. 1—Citrus branch showing work of cerambycid larva *Aneflomorpha citrana* Chemsak (twice actual size).

gence, two were found free of cerambycid larvae. One of the four remaining branches contained a live larva and three remained infested, but no emergence had occurred.

Larvae in different stages of development were found in in-

Fig. 2—Near mature larva of *A. citrana* Chemsak in citrus twig. C.E.S. Tempe, Arizona, January 1960. (Larva 3.5 times actual size.)

fested branches collected in January 1960. Some appeared to be second instar larvae while others were in the last instar. Inasmuch as live larvae have been observed in the branches in December and again in January (1960), it appeared evident that some larvae overwinter in the twigs and probably emerge early the following spring.

Thus far, this beetle has been found attacking only Valencia, Washington navel, Dillar and Butler varieties of orange trees. In February 1960 one grapefruit tree was found infested. It has not been found in lemons or tangerines, although they are located close to the infested planting of oranges.

Another grove of navel and Valencia oranges, located approximately ¼ mile southeast of the citrus experiment station, was also found to be infested with the same cerambycid.

An examination of specimens reared in 1956 and one specimen from 1957 indicated they belonged in the genus *Aneflomorpha* Casey 1912. In 1936 Linsley described six new species of *Aneflomorpha* of which two were from Arizona (*A. duncani* Linsley and *A. arizonica* Linsley). The other four were from California and Texas. Linsley also lists five other species of *Aneflomorpha*, four of which were described from specimens collected in Arizona. These are: *A. imbellis* Casey, collected in Globe, Arizona and Santa Ana Canyon, California; *A. unispinosa* Casey, collected in the Chiricahua and Huachuca Mountains of Arizona; and *A. parkeri* Knull, collected in the Pinal Mountains of Arizona.

Specimens of the cerambycid reared from citrus twigs in 1956 and 1959 were submitted to Dr. Linsley for identification. They have been found to represent a new species and have been described by Dr. John A. Chemsak (1960) as *Aneflomorpha citrana*.

Many of the other species of *Aneflomorpha* have been collected at light traps and have not been reared or associated with any specific host. However, hosts are likely to be mesquite, palo verde, willow or other woody shrubs which grow in the areas where these insects have been found. It is, therefore, speculated that *A. citrana* may have as a native host, mesquite, palo verde or some other woody shrub growing near citrus plantings. Additional collections or rearings may provide identification and association with one or more of the mentioned possible hosts.

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BOOK REVIEW

HOW TO KNOW THE BUTTERFLIES by Paul R. Ehrlich and Anne H. Ehrlich; 262 pp. (6 unnumbered —), 525 text figs. Spiral binding, $2.75; Cloth binding, $3.25. 1961. Publ. Wm. C. Brown Co., 135 South Locust Street, Dubuque, Iowa.

How To Know The Butterflies, like the previous issues of the familiar Jaques Pictured-Key Nature Series of "How To Know" books, is an identification manual. Previously it has been customary to serve the needs of those interested in the identification of butterflies with the periodic publication of colored plates accompanied by a text embodying recent advances compiled from the technical literature. The appearance of an adequate up-to-date identification guide to the North American butterflies seemed unlikely owing to the increase in the expanse of our knowledge and in the expense of color reproduction. This book treats all butterfly (Papilionoidea) species known in North America north of Mexico and in so doing departs in several particulars from the format to which we have become accustomed.

The authors enlisted the aid of specialists to contribute sections dealing with some of the more difficult groups; and new concepts of relationships, new combinations, and nine new generic or subgeneric names are published for the first time by these specialists. There are no color reproductions or photographs, but all species are accurately illustrated by the excellent drawings by Mrs. Ehrlich. The earlier emphasis upon the ribbon-matching technique for the identification of butterflies is abandoned. Identification is achieved by the use of keys, interpretation of the couplet statements being greatly aided by means of the accompanying diagrams and illustrations.

The usual introductory subjects are briefly considered, with rather more than usual detailed attention given to morphology, including that of male and female genitalia, and to laboratory techniques. Within the latter are discussions concerning genitalic preparations, preservation in fluids, and procedures for studying wing venation, skeletal morphology, and visceral anatomy. A phylogenetic diagram is provided in the section on classification. The introductory portion is written in a relaxed, non-technical style (although a large number of morphological terms are introduced), and the beginner will appreciate the ease with which much detail is provided.

The main body of the text consists of the illustrated keys to higher categories and species, and brief comments about these including, variously, statements of general facies, geographic range, larvae and food plants. The

keys, by and large, could be considered "ideal" in a sense. They are presented in brief, unambiguous abbreviated statements which usually involve only one or two characters. The reader is generally given a distinct choice of opposites leaving little room for doubt. The result is that the user will have no difficulty in naming a specimen with confidence in most groups. On the whole this confidence will be justified; but the keys occasionally, perhaps even frequently, sacrifice accuracy for ease of use. This reviewer, in briefly checking a few of the keys found, for example, that the relatively common dark form of *Papilio rudkini* Comstock keys out easily to *P. polyxenes* Fabricius. A short series of *Euchloe ausonides* Boisduval from central California contained some individuals which readily keyed out to *E. creusa* Doubleday and Hewitson, and others which properly ran to *E. ausonides*. In all fairness it must be emphasized that the authors clearly state in the introduction that in operating the keys the conclusion should be checked against the illustrations and statements of distribution provided. Other cautionary notations appear at the beginning of many groups where difficulties might be expected in the use of the keys. Anyone who has tried to prepare a satisfactory key will appreciate the problem confronting the authors in their choice between utility and invariable accuracy. There is little doubt that they have chosen wisely.

It was not considered a proper function of this book to present a formal synonymy. However, since the treatment conservatively considers species only, many names formerly in general use are briefly mentioned when considered to represent subspecies or synonyms. Certain of these names, however, have disappeared since the last check-list and their present position is not clear without reference to the technical literature. A combined illustrated glossary-index comprises the final part of the book. This section seems quite adequate to accomodate the certain considerable use resulting from the numerous technical terms in use through the text. The beginner will soon learn that, for example, the term "mesodiscrimen" is a composite word and therefore not to be found as such in the glossary.

A few minor errors have escaped editing. For example, the authors frequently interject, in the plural of the first person, comments of personal preference throughout the introductory pages, but on page 12 and twice on page 20, the singular of the first person is used. Such problems seem to be few, however; and the overall presentation is excellent. The intention of the authors, to present ". . . an inexpensive manual which will permit both the amateur butterfly collector and the professional entomologist to identify the species of North American butterflies" has been superbly accomplished. In addition the book is an essential technical work owing to the considerable original material contributed by the several specialists. The combined efforts of these specialists, with the extensive knowledge, industry and efficiency of Dr. Ehrlich and the magnificent illustrations by Mrs. Ehrlich, make this book a necessary reference for anyone, no matter what level of interest, concerned with the identification of butterflies; and the price insures its availability to all.—C. Don MacNeill, *California Academy of Sciences, San Francisco.*

FIVE NEW OREGON THYSANOPTERA

RICHARD LEWIS POST
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In the course of the writer's investigations on the taxonomy of Oregon Thysanoptera for his Ph.D. thesis, five thrips were found to be new after comparison with material in the extensive collection of the late Dudley Moulton.

Aeolothrips fasciatus justiceae Post, new subspecies

(Fig. 1)

The new subspecies has the same general form and color as the nominate subspecies except for the color of the antennal segments by which it is easily distinguished. Subspecies *justiceae* (Fig. 1) has the first antennal segment light brown, much lighter than the head, and segments II and III clear white except a weak shading of brown at the extreme apical end of segment III. *A. fasciatus fasciatus* (Linnaeus) (fig. 2) has the antennal segments brown, about the color of the head, except the tip of II and basal ⅞ of III which are a pale yellowish-brown.

Holotype female taken at CASCADE LOCKS, HOOD RIVER COUNTY, OREGON, July 4, 1944, collected by Leah Justice Post in home from bouquet of cultivated flowers, deposited in Moulton collection at the California Academy of Sciences. Paratype female Portland, Oregon, July 14, 1940, collected by Joe Schuh from insect borer tunnel in lupine stem, deposited in author's collection at NDSU. Eight female paratypes, in poor condition, Troutdale, Multinomah County, Oregon, July 30, 1940, collected by Joe Schuh on gladiolus, deposited in Oregon State College Collection.

The range of *A. fasciatus* is nearly world-wide; it occurs throughout North America from Hudson Bay to Florida and Mexico. The subspecies *justiceae* has been recorded in a limited area from three localities in northeastern Oregon. Based on the experience, opinion and advice of Dudley Moulton it is considered a local population which closely resembles *fasciatus* but is distinct enough to be named a subspecies and is so described.

The author is naming this subspecies after his wife, Leah Justice Post, who continued to collect thrips while the writer was in military service.

Chirothrips moultoni Post, new species.

(Fig. 3)

Holotype female: Head, thorax and the last two abdominal segments blackish brown, abdominal segments brown shading darker towards apical end; antennae and legs blackish brown with third segment a shade lighter and fore tarsi yellow, middle and hind tarsi brown; fore wings uniformly

brown with a cleared area near base, lower wings brown only at extreme base otherwise clear. *Measurements:* Total length with abdomen distended 1.89 mm.; head length 0.133 mm.; width across cheeks 0.118 mm.; length of cheeks 0.036 mm.; length of head projection anterior to eyes 0.018 mm.; thorax median length 0.226 mm.; width near anterior margin 0.140 mm.; near posterior margin including coxae 0.260 mm.; inner setae on posterior angles of prothorax, 43, outer 43 microns. *Head:* clearly longer than wide and distinctly produced in front of eyes, this projection from eyes to outer bases of antennae somewhat less than half the length of cheeks; broadly angular in front; eyes occupying approximately two-thirds the side of head; posterior ocelli placed contiguous with posterior, inner angles of eyes; ocellar setae placed directly on a line passing through anterior ocellus; with only two minor setae anterior to ocelli; antenna with second segment produced, with blunt, not pointed tip and without terminal setae; segments III to VI broadly ovate, with simple sense cones. Thorax and body typical of the genus, with fore legs only slightly enlarged; fore wings with 3–4 basal, 1 median and 2 apical setae, lower vein with 8 widely spaced setae. Terminal abdominal segments pointed much as in *aculeatus*.

Holotype female and one female paratype taken at PITBLADO RANCH, THREE MILES SOUTH OF HOOD RIVER, HOOD RIVER COUNTY, OREGON, January 31, 1946, by the writer from dried blossoms of pigweed, *Amaranthe*. Holotype in Moulton Collection at the California Academy of Sciences. Paratype in Oregon State College Collection.

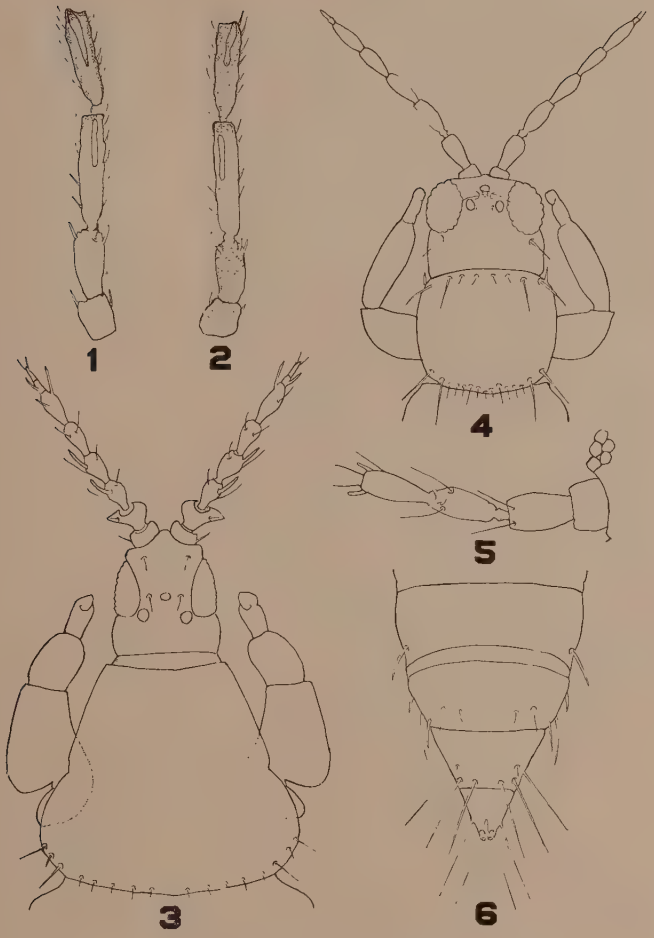
This species is most closely related to *C. productus* Hood known from North Dakota but is immediately separated by its darker color and the lesser number of minor setae anterior to ocelli.

This species is named after the late Dudley Moulton with whom the writer spent ten days in March of 1946 examining every slide in his collection of more than 44,000 specimens for Oregon records. Without Mr. Mouton's assistance, positive identification of many species would have been impossible.

Frankliniella terminalis Post, new species

(Figs. 4, 5 and 6)

Holotype female– Head and thorax light orange yellow, abdominal segments I–VIII light brownish yellow, shading from yellow at base to light brownish yellow, segments IX and X rather abruptly blackish brown; antennal segment I brownish yellow, darker than head, II blackish brown at sides, lighter through median portion, III mostly yellow shading to dark brown in apical third, IV and V yellowish in basal third, otherwise dark brown, VI–VIII blackish brown; legs nearly clear yellow; wings weakly shaded yellow; prominent setae dark. *Measurements:* Total body



Explanation of Plate

Fig. 1—Antennal segments I–IV *Aeolothrips faschiatus justiceae* Post. Fig. 2, Antennal segments I–IV *Aeolothrips fasciatus fasciatus* (L.). Fig. 3, Head and prothorax of *Chirothrips moultoni* Post. Figs. 4–6, Head and prothorax, antennal segments I–IV, and terminal abdominal segments of *Frankliniella terminalis* Post.

length with abdomen distended 1.44 mm.; head length 0.117 mm.; width 0.147 mm.; antennal segments length (width): II, 36(23); III, 53(16); IV, 43(16); V, 35(15); VI, 46(16); VII, 10; VIII, 16 microns; length of setae, interocellars 23, postoculars 20; on anterior margin and angles of pronotum 43, on posterior angles 56; on ninth abdominal segment median 86, midlateral and lateral 100; median pair on tenth segment 110, lateral 93 microns. *Head:* somewhat wider than long, cheeks nearly straight, slightly constructed posteriorly; interocellar and postocular setae prominent, the interoccelars placed on a line connecting anterior with posterior ocelli, their interval 30 microns; antennae slender, segment II slender, the prominent setae placed immediately at apical end as in *cephalica*, the segment not drawn out or overhanging base of third segment; pedicel of segment III with a distinct but weak angulation, apical end of third segment briefly constricted; segment VIII clearly longer than VII. Legs normal, inner, apical inner margin of hind tibiae with a series of about five short, dark setae; fore vein of fore wing with 20, lower vein with 17 setae. Abdomen normal, posterior margin of eighth segment with comb; pronotum with four minor setae between antero-marginals.

Holotype female taken at BRUCE STATION, ELEVEN MILES SOUTH OF CORVALLIS, BENTON COUNTY, OREGON, February 17, 1946, collected by Leah J. and R. L. Post from galls of beaked willow gall, *Phytophaga rigidae* O. S. via Berlese funnel, deposited in Moulton Collection at California Academy of Sciences. Two paratypes taken at Corvallis, Benton County, Oregon, December 2, 1945, collected by Leah J. Post and the writer from moss on oak via Berlese funnel. Paratypes in Oregon State College collection and writer's collection at NDSU.

This species is placed in the *tritici* section of the *tritici-cephalica* group. The angulation on the pedicel of segment III is weak, but the prominent setae on segment II are at the extreme apical end of the segment as in *cephalica*. It is most closely related to *bicolor* Moulton from Brazil but separated from that species by the darker colored basal segments of the antennae and the absence of a comb on the eighth abdominal segment. *F. extremitata* Hood, also with darkened terminal abdominal segments, has much longer antennae, the third segment being 75 microns, and there are only two minor setae on the anterior margin of the pronotum between the antero-marginals. There are four such minor setae in the present new species.

The terms "*tritici* section" and "*tritici-cephalica* group" are based on terms that Moulton (1948) has employed in a revision of the genus *Frankliniella*.

Toxonothrips gramineae fuscus Post, new subspecies

(Fig. 7)

Length 1.6 mm. General color brown, except antennal segment III and tibiae and tarsi which are yellow.

An examination of the holotype of *Toxonothrips gramineae* Moulton in the Moulton collection shows the third and fourth antennal segments nearly clear yellow and segment V yellowish at base and shading to light brown apically; legs are mostly brown with fore tibiae yellowish but shaded on outer margin, middle and hind tibiae brown but lighter at apical ends. In this new subspecies only antennal segment III is yellow, faintly shaded at the sides and IV is lighter at extreme base; femora are brownish yellow and all tibiae and tarsi nearly clear yellow.

Holotype female and one paratype collected ONE MILE EAST OF TIDEWATER, LINCOLN COUNTY, OREGON, January 1, 1946, collected by Leah J. and R. L. Post on dead flowers of red sorrel, *Rumex acetosella*, holotype in Moulton Collection at the California Academy of Sciences. Paratype deposited at the Oregon State College Collection.

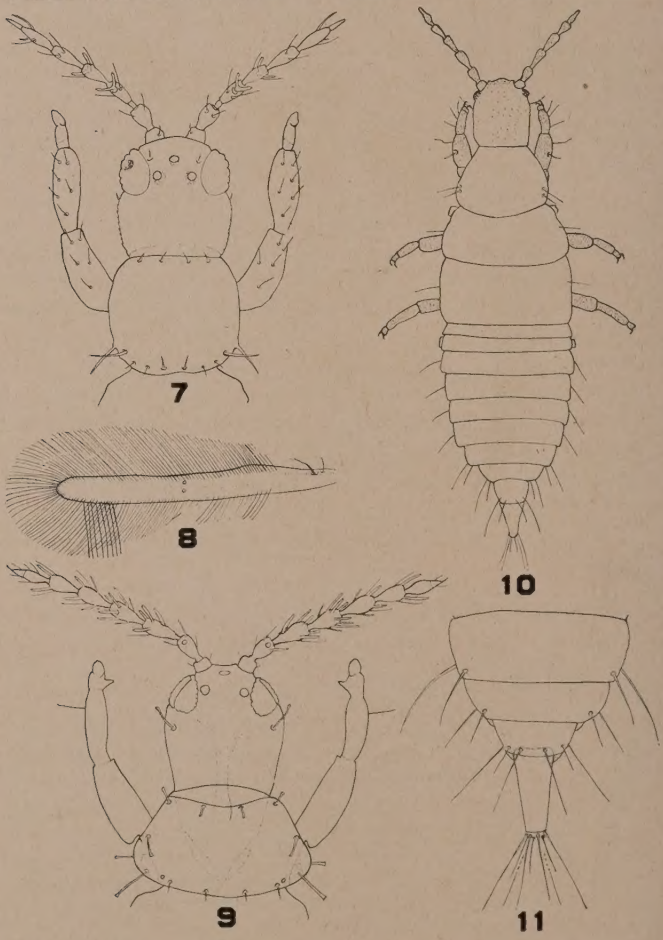
The genus *Toxonothrips* Moulton is monotypic with *T. gramineae* Moulton the type of the genus. Prior to the Oregon records only three specimens of the type series were known. These were taken from grass sweeping at Lake Tahoe, California in July 1926. Mr. Moulton who examined the Oregon specimens stated that they were very close to his *gramineae* and that a local distinct Oregon population apparently exists and should be considered a subspecies.

Bolothrips lativerticis Post, new species

(Figs. 8, 9, 10, and 11)

Holotype female: Total length 2.8 mm. Color blackish brown, nearly black including legs, with abdominal segments one to five somewhat lighter; antennal segments I, II, and V–VIII blackish brown, III yellow in basal half, IV and V yellow in basal fifth; wings lightly washed with brown. All setae without color. *Measurements:* Head length 0.323 mm., width 0.315 mm.; prothorax, median length of pronotum 0.22., width including coxae 0.455 mm.; tube length 0.22 mm., width at base 0.095 mm., at tip 0.044 mm. Antennal segments length (width): II, 76 (43); III, 76 (46); IV, 86 (50); V, 80 (40); VI, 76 (40); VII–VIII, 100 microns; length of setae: postoculars 75; on anterior margin or pronotum, present but length undetermined, on anterior angles 40; inner on posterior angles 86, outer 75; median on ninth abdominal segment 166, on posterior angles 216; terminal setae 200 microns. *Head:* approximately as long as greatest width behind eyes; forehead flattened in front between widely separated basal antennal segments, this measurement 60 microns, cheeks swollen behind eyes, then evenly narrowed to base; eyes relatively small, slightly

flattened on outer margin, broadly angular on inner margin, produced only a little on ventral surface; mouth cone broad but narrowed before end where it extends to posterior margin of prosternum; antennae 1.8 times longer than head, segments III to V broadly club-shaped, VII and



EXPLANATION OF PLATE

Fig. 7—Head and prothorax of *Toxonothrips gramineae fuscus* Post. Figs. 8–11, Forewing, head and prothorax, larva, and terminal abdominal segments of *Bolothrips lativerticis* Post.

VIII united as a unit, segment III with three stout, blunt sense cones, one on inner and two on outer apical margin; segment IV with four, two on inner and two on outer margin; postocular setae well developed, with blunt tips and placed well back from eyes, rather close to side margins of head. *Thorax:* prothorax transverse, weakly emarginate in front, all normal setae developed, with blunt tips; pterothorax only slightly wider than prothorax, abdomen normal, terga without sigmoid setae; tube 0.7 as long as head, 2.3 times longer than width at base; terminal setae approximately as long as tube. Fore femora not greatly enlarged, fore tarsus with a strong, nearly straight and moderately sharp tooth. Wings of even width, fore pair with 8–13 double fringes.

Larvae with vertex, antennae and legs dark brown, otherwise the entire head and body with deep red pigmentations.

Holotype female, three eggs, and 21 larvae taken at HERMAN CREEK, NEAR CASCADE LOCKS, HOOD RIVER COUNTY, OREGON, January 31, 1946, collected by the writer from hollow terminal twigs of elderberry, *Sambucus racemosa*. Holotype in Moulton Collection at the California Academy of Sciences. Paratype female and six larvae taken at Myrtle Creek, near Ophir, Curry County, Oregon, March 1, 1946, collected by R. L. Post from hollow terminal twigs of elderberry, *Sambucus*, in author's collection at NDSU. One paratype female, 42 larvae, and 10 prepupae, Corvallis, Benton County, March 23, 1946, collected by Leah J. and R. L. Post from stems and twigs of elderberry, *Sambucus*, via Berlese funnel, deposited in Oregon State College collection.

This species is distinct from other known species in the relatively short head, this being about as long as wide, and more especially by the greater width between the basal segments of antennae.

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1948. The genus Frankliniella Karny, with keys for the determination of species. Revista de Entomologia 19:55–114.

BOOK NOTICE

FOREST AND SHADE TREE ENTOMOLOGY. By Roger F. Anderson. John Wiley & Sons, Inc., New York and London, pp. viii + 428, 126 text figs. September 15, 1960. Price $8.50.

This attractive book is well suited as a text for courses in forest entomology and is an excellent manual for foresters and all who travel our forested areas. Section I, with eight chapters, deals with the basic aspects of entomology (structure, physiology, development, classification, ecology,

pest control, insecticides and their application, forest insect surveys); one might wish for more warnings throughout the text about the dangers to humans of some of the insecticides recommended—perhaps not all users of the book will read page 70. Section II contains chapters 9–15 and is followed by a host index. The insects are grouped by the type of damage they do (defoliating, inner-bark boring, wood boring, sapsucking, bud-, twig-, and seedling-damaging, root feeding, cone and seed destroying).

Nearly all illustrations are original; most are adequate some are excellent. Larvae are usually pictured from inflated skins, and because of over- or under-inflation many have unnatural forms. The author is to be commended for the many identification keys, most of which use field data; they are so skilfully made that they can be used by the non-professional, yet give accurate results. The nomenclature is up-to-date.—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*

NEW RECORDS FOR THE GENUS NALLACHIUS NAVAS

(Neuroptera: Dilaridae)

The New World genus *Nallachius* is comprised of six rarely collected species. Therefore the following records are reported in order to increase the distributional knowledge of certain species of this genus. Only two species, *N. americanus* (McLachlan) and *N. pulchellus* (Banks) are found in the United States.

N. americanus has been recorded from many localities in the eastern U.S. and also from Puerto Rico by Steyskal (1944)[1], Carpenter (1947)[2], and Gurney (1947)[3]. The westernmost record is Bee Spring, Kentucky. I collected a male of this species three miles west of Woodville, Texas, on September 1, 1960, which is a significant extension of its range. It was attracted to ultraviolet light at 11 o'clock in the evening.

N. pulchellus was originally described from Cuba. A single male specimen has been recorded from the U.S. by Carpenter (1940)[4], collected in the Santa Rita Mountains, Arizona. I have seen a female of this species from Sunnyside, Huachuca Mountains, Arizona. It was collected at ultraviolet light on July 8, 1958, by Lloyd Martin and is deposited in the Los Angeles County Museum. This record supports the apparent discontinuous distribution of the species.—L. STANGE, *University of California, Davis.*

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[1] Steyskal, G. C., 1944. Notes on *Nallachius americanus* (McL.) (Dilaridae, Neuroptera). Psyche 51:183-184.

[2] Carpenter, F. M., 1947. Taxonomic notes on the Dilaridae. Psyche 54:100-109.

[3] Gurney, A. B., 1947. Notes on Dilaridae & Berothidae, with special reference to the immature stages of the Nearctic genera (Neuroptera). Psyche 54:145-160.

[4] Carpenter, F. M., 1940. A revision of the Nearctic Hemerobiidae, Berothidae, Sisyridae, Polystoechotidae and Dilaridae (Neuroptera). Proc. Amer. Acad. Arts and Sci. 74:193-260.